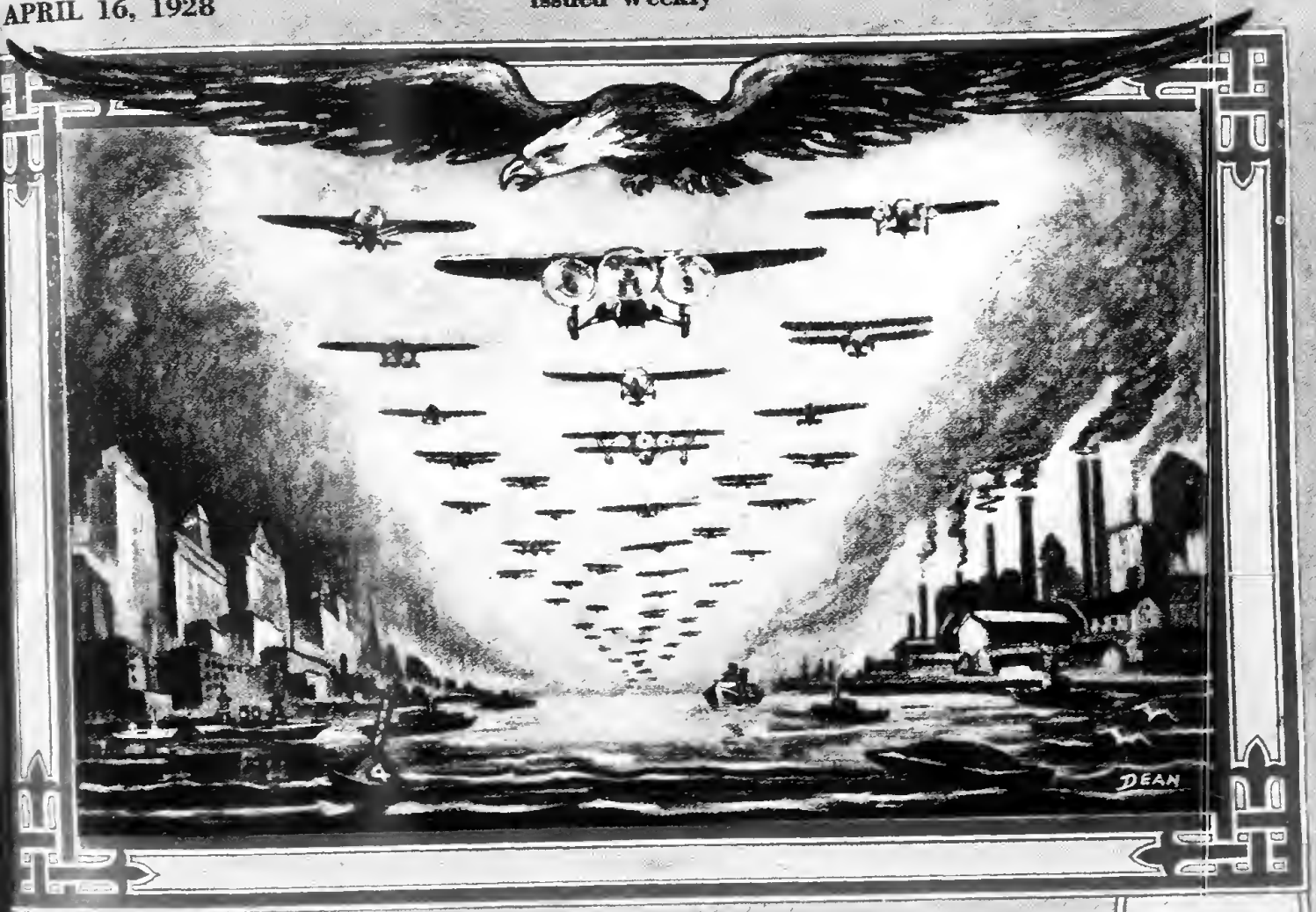
AVIATION

The Oldest American Aeronautical Magazine

APRIL 16, 1928 Issued Weekly PRICE 20 CENTS



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All-American Aircraft Show Number

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Fairchild Cabin Plane (Wasp)
as used by the Canadian Transcontinental Airways

Reserve Power

RESERVE POWER in all aircraft is of great importance, and a necessity in commercial aviation It provides a greater factor of safety, increased dependability, and longer life. An important step in American commercial aviation of 1928 will be recognition of the factor of RESERVE POWER.

"WASP" engines in the Fairchild monoplanes of the Canadian Transcontinental Airways provide the necessary RESERVE POWER. Quick take-off, with the combination skis and pontoons with which this ship is equipped, is vitally essential in the transportation of the Air Mail from the mouth of the St. Lawrence River to Quebec.

THE
PRATT & WHITNEY AIRCRAFT CO.
HARTFORD CONNECTICUT

DEPENDABLE ENGINES

Red Arrow Monoplanes

MANUFACTURED BY THE SIMPLEX AIRCRAFT CORPORATION, DEFIANCE, O.

2 PLACE OPEN 2 PLACE CLOSED 3 PLACE CLOSED

Speed—Cruising 110 M.P.H.—Top 120 M.P.H.—Landing 38 M.P.H.—Cruising Radius 1200 Miles. *Power*—Kinner 100 H.P. 5 Cylinder Radial Aircooled Motor—Others at Adjusted Price Wing Spread 33' 4"—Length 20'—Seating Side by Side—Control Dual. *Very Desirable Sales Territory Open.*

WACO - TEN
RYAN SIEMENS

What WACO Shows
. . . others will eventually offer

WHEN A PRODUCT leaps into prominence, through unusual performance, and continues growing in favor month after month, year after year, it surely must offer unique qualities and values.

The air-minded, are recognizing more and more how WACO engineering and production methods are *constantly leading the way* How refinements and improvements are first given the public, as standard equipment on WACO planes

Approve type certificates Numbers 11 — 13 — 26

WACO was first to offer — complete production planes at moderate prices — all steel fuselages — center sections — enclosed cowls — dual controls — side door and wing step — adjustable stabilizer — quick take off — fast climb — slow landing speed — high top speed.

Now WACO pioneers, with the quantity production of airplanes utilizing new type motors WACO engineers have developed the super structure of the WACO TEN to take full advantage of Whirlwind — Ryan Siemens — Continental and OX5 motors. This wonderful plane — the acknowledged leader in its class — now gives more performance and is more dependable than ever

WACO offers CHOICE OF FOUR MOTORS — a wonderful range of performance — a price field to satisfy every one. See them at the All-American Aircraft Show — Detroit, April 14th, to 21st.

WACO AIRPLANES

ADVANCE AIRCRAFT COMPANY
TROY OHIO

Lindbergh completes 42,000 miles of flying— with Mobiloil

Since he left San Diego last May, Col. Lindbergh has flown more than 42,000 miles in the "Spirit of St. Louis."

For all this flying, Col. Lindbergh has used the same engine and the same lubricating oil—Mobiloil. The Mobiloil used by Lindbergh is not a special oil. It is Mobiloil "B", the choice of most careful aviators.

LINDBERGH'S 42,295 miles —with Mobiloil

From San Diego to New York	2,500 miles
From New York to Paris	3,625 miles
Short flights in Europe	430 miles
Flights in U. S. A. including tour of every State in Union	26,350 miles
From Washington to Mexico, Central and South America, West Indies—and back to St. Louis	9,390 miles plus
TOTAL	42,295 miles

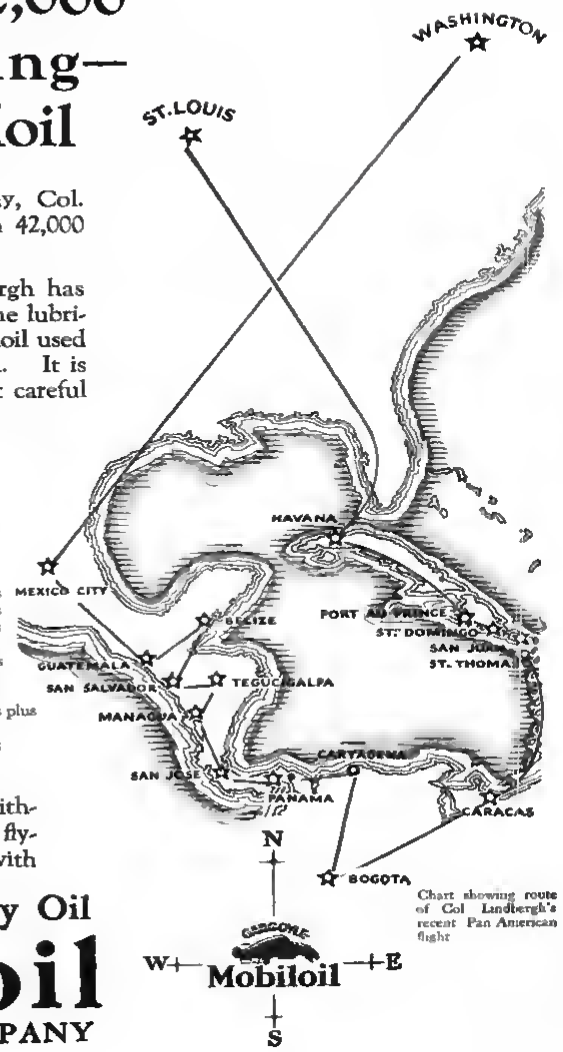


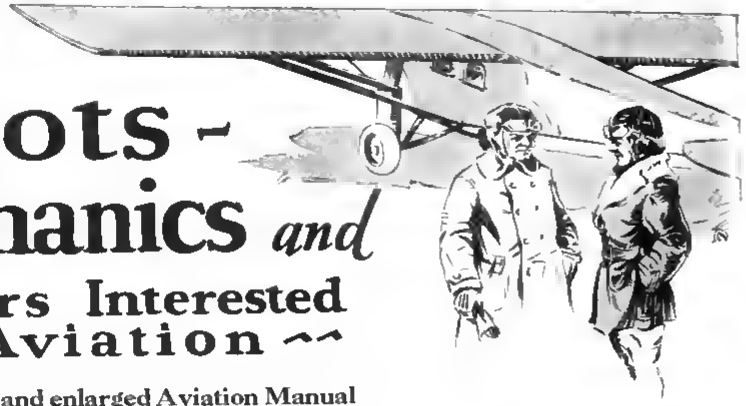
Chart showing route of Col Lindbergh's recent Pan American flight

You can buy Mobiloil at or within reasonable distance of every flying field. You are always sure with

The World's Quality Oil

Mobiloil

VACUUM OIL COMPANY



Pilots - Mechanics *and* Others Interested in Aviation

Our revised and enlarged Aviation Manual will be off the press when this announcement appears in print.

The last edition of the manual proved so popular that the supply was soon exhausted.

This 1928 edition contains much new and valuable material. Besides information relative to types of aero motors, and the characteristics that distinguish good aero gasoline and oil, it gives the names of 1,800 towns and cities where this company has painted the roofs of its warehouses with the names of the respective communities; also a list of the Airports and Landing Fields throughout the Middle West.

The enlarged Manual should be in the hands of every aviator and mechanic flying in the Middle West or traversing this part of the country on trans-continental flights. A copy will be sent free upon request.

Use the coupon.

STANDARD OIL COMPANY
(Indiana)
910 South Michigan Avenue Chicago, Illinois

Stanolind Aviation Gasoline and Stanolind Aero Oil may be had at all warehouses, airports and landing fields listed in the Manual. The Standard Oil Company of Nebraska and the Standard Oil Company of Ohio have stocked Stanolind Aero Oil, and are prepared to serve planes in the states of Nebraska and Ohio, respectively.

STANDARD OIL COMPANY (Indiana) US
910 South Michigan Avenue, Chicago, Illinois
Please send me a copy of your *revised* Aviation Manual

Name _____

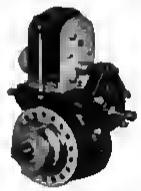
Address _____

City _____

State _____

OVER a period of twelve years, Eclipse has specialized in the design and production of Aviation Engine Starters + This experience is reflected today in a complete line of starters and generators, built to fit almost every type of engine, and to meet all operating conditions + Write for full information, specifying the engine on which you are interested in installing a starter +

Eclipse Series 7 Combination Hand and Electric Inertia Starter. Vertical type, adapted for V-type or radial engines up to 2500 cubic inches.



Eclipse Aviation Hand Starter with Booster Magneto Integrally mounted. Hand-starting gear 6:1 Reduction for Engines up to 900 cubic inches; 12:1 Reduction for Engines up to 1400 cubic inches; 18:1 Reduction for Engines up to 2000 cubic inches.

Eclipse Series 7 Hand Inertia Starter. Vertical type, adapted for V-type or radial engines up to 2500 cubic inches.

Eclipse Direct Cranking Combination Hand and Electric Starter, adapted for application on engines up to 2000 cubic inches.

Eclipse Series 6 Combination Hand and Electric Inertia Starter for radial engines up to 1350 cubic inches. Series 11 Combination Hand and Electric Inertia Starter for radial engines up to 2500 cubic inches. Concentric type, with magnetic switch.

...ne Series 6 Hand Inertia ...r Concentric type, particularly adapted for radial ...nes up to 1350 cubic ...es. Series 11 Hand Inertia ...r for radial engines up ...00 cubic inches.

Eclipse Aviation Generators, 15 Volt, 15 Ampere capacity and 15 volt, 25 ampere Capacity, voltage regulated, Engine driven type.

ECLIPSE MACHINE COMPANY
EAST ORANGE PLANT
Elmira, New York East Orange, New Jersey Walkerville, Ontario

ECLIPSE

AVIATION ENGINE STARTERS AND GENERATORS

When Lindbergh said "We" he included AC

THROUGH his magnificent flights over Mexico, Central America, and the West Indies, Col. Lindbergh continued his great work as good will ambassador of the United States. And once again the world wonders at *the 100-per-cent success of Lindbergh performance.*

Skill, courage, vision, indomitable will — all these are Lindbergh's. Yet he was first to acknowledge the part played by his equipment and to single out for special mention AC Spark Plugs

And so with Chamberlin, Byrd, Acosta, Maitland, Hegenberger, Stinson, Myers, Schlee and Brock. All these great flyers are users of AC Spark Plugs.

In developing spark plugs with sufficient stamina to withstand the test of the longest endurance flights, AC has made available to all flyers plugs of known quality

There is a type and size for every engine. The letters AC identify these plugs, *proved by every test standard of the world.*

AC-SPHINX Birmingham ENGLAND | AC Spark Plug Company FLINT, *Michigan* | AC TITAN Clichy (Seine) FRANCE

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AC SPARK PLUGS AC OIL FILTERS AC FUEL PUMPS AC AMMETERS
AC GASOLINE STRAINERS AC OIL GAUGES AC THERMO GAUGES

A CONTRIBUTION

to Aeronautical Science

FLIGHT — man's realization . . the Wright brothers pushed out of their bicycle shop the first heavier than air machine. It flew.

Flight — man's pursuit . . . hazardous . . . discouraging . . the clumsy floundering of the fledgling . . . now up, now down, struggling and striving for power, for safety . . . speed . . endurance.

Then! War birds . . . dashing daring sacrifice . . . not in vain, but for the advance of science . . the triumph of aviation.

Came peace . . . pinions of progress . . . oceans spanned . . worlds united.

Now! The era of flying with altimeters, speed indicators, direction finders . . what next? . . . Fuel . . . the occult power that makes it all possible

Flying has reached the efficiency, the economy stage

It has taken unto itself a valuable auxiliary in Naturaline, the super fuel embodying the important and obvious advantages of *quick starting, . . pick up, increased revolutions per minute* (from 50 to 125) *greater speed* 20 to 25% *more power.*

High volatility without gas lock, complete combustion and complete burning even at low temperatures, does not freeze at high altitudes and WEIGHS 46 POUNDS PER 100 GALLONS *LESS THAN U. S DOMESTIC AVIATION FUEL*

This characteristic alone gives to the user of Naturaline the great advantages of increased efficiency, more pay-load, less strain, longer flight, an important factor when the margin of profit in commercial flying is squeezed down in the wine press of intense competition . . . an **even more** important factor *now* when commercial air ways are being subsidized to get them on a paying basis

Naturaline was evolved and perfected in our laboratories, tested and tried through scientific and exhaustive research, then proven . . . proven in the motors of planes, piloted by men qualified to judge . . proven in thousands of miles of actual flying . . . a deserving contribution to the advance of Aeronautical Science, a deserving auxiliary that keeps the plane aloft with greater power to lift, power to carry, power to endure, with power and affinity to climb higher and higher.

CHESTNUT & SMITH
CORPORATION
CHESTNUT & SMITH BUILDING
Tulsa Okla.

See the New B. B. T. Landing Floodlight at the Aircraft Show

Illumination from the New B. B. T. Intermediate Air Mail Type Landing Floodlight

The Ideal Floodlight for the Medium Size Field or for Preliminary Installations

All the advantages of the single light source are provided in this unit constructed on the same principle and incorporating many of the features of our large Air Mail Floodlight.

The 180 degree angle of illumination from this type H-8-D light permits the use of the maximum landing area.

The objections to the multiple unit system—expensive cost of installation and glare in the eyes of the pilot in passing from one light to another—have been effectively overcome.

This new unit using a 5 KW incandescent lamp is the most economical airport landing floodlight.

Let us tell you more about this floodlight and send you our complete catalog—"Airport Lighting"

B.B.T. CORPORATION OF AMERICA

ATLANTIC BUILDING PHILADELPHIA PENNA.

Wax *free*

gives a tougher, heat-resisting body [*summer protection*]

More interesting than its rigid specifications is the performance record of A-M-L-O. *After twenty hours of high speed running in a Curtiss OX-5 motor A-M-L-O was drained and tested. The body was still good, and dilution was hard to notice . . . the oil was too good to throw away.

**Name and full details on request.*

Free Pilots Log book, 36 pages of blank forms with handsome, durable cover. Free to you, send the coupon.

Texas Pacific Coal & Oil Co.
Fort Worth, Texas

Please send me without obligation your Pilots Log book described above, and oblige.

Name .....
Address .....
City ..... State .....
Your Dealer's name .....

Announcing the New Aero-Coupe

an airplane that is distinctively different

The Aero-Coupe produced by the Aero-Craft Manufacturing Company, Inc., Detroit, will make its debut at the All-American Aircraft Show. This new product, embodying every modern construction feature of merit has exceeded its designer's greatest expectations. The Aero-Coupe is a two-passenger closed cabin plane with open cockpit for the pilot and is an ideal ship for long distance taxi service—for mail and express feeder lines or for sight-seeing tours—cruising speed over 100 M. P. H.

SPECIFICATIONS

Span Upper Wing	32 Ft.
Span Lower Wing	28 Ft.
Wing Area	250 Sq. Ft.
Pay Load	550 Lbs.
Total Load	1000 Lbs.
Net Weight	1100 Lbs.
Gross Weight	2100 Lbs.
Cruising Speed	100 M.P.H.
High Speed	115 M.P.H.
Cruising Radius	600 Miles
Length Overall	24 Ft.
Height	8 Ft. 6 inches
Undercarriage Tread	6 Ft.

See this ship at the All-American Aircraft Show, Detroit, April 14th to 21st, or write for detailed information

AERO-CRAFT

INCORPORATED

AERO-CRAFT MANUFACTURING COMPANY, INCORPORATED

1489 East Fort Street, Detroit, Michigan

New THE VIKING

STRONG—POWERFUL—an adventurer into the great air spaces. Everything you ask for in air travel—comfort—speed—safety—visibility—economy in original cost and performance.

This newcomer marks a step forward—a decided advance in airplane manufacture and construction. It is designed to do one thing—to carry your loads swiftly and safely at a minimum of cost. Inspired by the Vikings of old, it pushes forward to new conquests, greater achievements through the air. See the Viking at the All American Aircraft Show in Detroit, or if it is impossible for you to attend, send for our catalog and booklet, "Pay Load Profits."

SPECIFICATIONS

Span	36 ft.
Chord	6 ft. 6 in
Wing Area	234 sq. ft.
Height	8 ft.
Length	26 ft. 1 in
Wheel Tread	7 ft.

DATA

Weight empty	1100 lbs
Useful load	1000 lbs.
Total weight loaded	2100 lbs.
Fuel capacity	50 gal.
Accommodations	3 passengers and pilot

PERFORMANCE

High speed	105 M. P. H.
Cruising speed	95 M. P. H.
Stalling speed	37 M. P. H.
Gas consumption	10 gal. per hr. full throttle
Oil consumption	1½ qts. per hr.
Wing loading per sq. ft.	9 lbs.
Power loading, 120 Anzani	17.5 lbs. per H.P.

Performance calculated from engineering data

VIKING AIRCRAFT COMPANY

745 South Clark Street, Chicago

VIKING

Micarta propeller on OX5 engine in Waco plane at Bettis Field Cleveland Pittsburgh air mail depot, with D Barr Peat, manager of the field

New Micarta Propeller for the OX5

Light - Durable - Adjustable Pitch

Westinghouse Exhibit
Detroit All-American Aircraft Show

Airport Floodlight Projectors
Boundary Lights
Approach Lights
Obstruction Lights
Hangar Lights
Reflectors
Transformers
Micarta Propellers
Micarta Pulleys
Micarta Fairleads

A NEW model of Micarta propeller for the Curtiss OX5 engine has successfully passed rigid tests at Wright Field.

This propeller is extremely durable and light in weight. It has an adjustable pitch and is unaffected by moisture or change in temperature.

The long-felt need of a propeller for the OX5 engine, possessing these qualities, has now been met.

Send for Special Publication 1791—Westinghouse Contribution to Aviation.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania

Sales Offices in All Principal Cities of the United States and Foreign Countries

Westinghouse

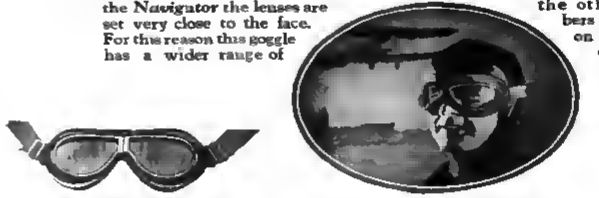
MICARTA PROPELLER

LAMOGLAS NAVIGATOR

EYES FOR THE SKIES

Companion to the Celebrated "Seesall"

A MONTH ago *Seesall* was almost unknown. Today it is the most wanted aviation goggle . . . ¶ Now Lamoglas has produced the *Navigator*, a worthy mate of the *Seesall*, with the added safety feature of non-shatterable lenses. The *Navigator* possesses nearly all the unusual features which have so quickly popularized the *Seesall*; only in range of vision does *Seesall* excel. Snug-fitting, wind-proof, with scientific indirect ventilation, the Lamoglas *Navigator* can be worn for hours without discomfort; you may forget to take it off. In the *Navigator* the lenses are set very close to the face. For this reason this goggle has a wider range of vision than any other non-shatterable goggle. The famous Lamoglas lenses used in the *Navigator* assure absolute optical clarity and maximum light penetration. This marvelous goggle, the Lamoglas *Navigator*, costs only $8.50 a pair. ¶ There are Lamoglas dealers most everywhere. But if you cannot find one, send us your check for $8.50 and we will send you your *Navigator* by return mail. If upon receipt you are not fully satisfied with your purchase, we shall cheerfully and immediately refund your money. The same guarantee applies to the *Seesall* and the other Lamoglas numbers shown below. Insist on the genuine, created only by Lamoglas.



LAMOGLAS 44
$6.50 per pair
Sponge Rubber Binding

"SEESALL"
$15.00 per pair
Other Lamoglas goggles as low as $3.75
Send for complete catalog

LAMOGLAS 36
Heavy Chenille $5.00 per pair

Lamoglas 39 (Same as 36)
But with triple chenille
$6.00 per pair

So Selling Agents
BECK DISTRIBUTING CORP. BECK 78 EAST 131st ST., NEW YORK

Wholesale orders west of the Rockies filled from stock by: R. Maier & Sons, Maier Building, San Francisco, Cal.

Champion
announces a new
Aviation spark plug

World's Altitude and Speed Records

Champion's new Aviation spark plugs help to establish two new world's records.

Altitude — December 21, 1927. Major Renato Donati in Romeo Jupiter-motored plane. Height 38,793 feet.

Speed—November 9, 1927. Major Mario de Bernardi in a Macchi Fiat plane broke all land and seaplane records with an official average of 298.7 miles per hour. Maximum speed 313.65 miles per hour.

Developed after two years of exhaustive tests and already accepted by engineers as a far advance in spark plug design and manufacture.

An achievement and an innovation in design, the new Champion Aviation spark plug has been developed to function perfectly under the widely varied conditions to which an aviation spark plug is subjected. The new Champion Aviation spark plug owes its superior performance and unique design largely to Sillimanite, the finest insulating material known — controlled and used exclusively by Champion.

You can't know just how sweetly your engine can idle or answer the gun, until you install a full set of these new Champion Aviation spark plugs.

Write for Descriptive Folder

CHAMPION *Spark Plugs*
TOLEDO, OHIO

PRUDDEN
ALL-METAL TRI-MOTOR

Most People Would Like to FLY

THE PRUDDEN has been created for those who want to fly with absolute comfort and safety. Three quiet and vibrationless motors insure continuous power over that stretch where engine failure might mean destruction and eliminate the necessity of forced landing due to mechanical troubles. All-metal gives definite assurance of full and continuous strength of every structural part from the time it leaves the factory as long as the ship is flown. Unexcelled flying qualities are a joy and comfort to pilot and passengers. The Prudden all-metal, tri-motor is fire and weatherproof... virtually crash-proof, reliable and economical.

Luxurious upholstering and trim of the highest quality obtainable affords comfort to those who know only the finest.

$25,000 Flyaway

PRUDDEN-SAN DIEGO
AIRPLANE COMPANY
San Diego, California

"Catalog on Request."

Safety, comfort & economy insure patronage & profit

LANSING AIRPORT SELECTS SPERRY ARCS

2 Sperry 3-Purpose Safety Arc Floodlight Units at the Capital City Airport, Lansing, Michigan

AFTER careful investigation a Sperry Revolving Beacon and two Sperry 3-Purpose Safety Arc Floodlights were selected by the Municipal Airport at Lansing, Mich. The selection of the Floodlight Units was based on merit in the following order. Efficiency, Low first cost, 3-Purpose uses, Low operating cost.

AIRPORT ARC FLOODLIGHT — As a floodlight this powerful unit spreads an 80° fan of light of 1,000,000 candlepower evenly over the field covering over 50 acres. As the unit swivels it can be trained to any part of the field. May be used in units of one, two or three, all remotely controlled.

EMERGENCY BEACON — Within a few seconds the spread lens may be hinged back to permit the 30,000,000 candlepower beam to be used as a high power Emergency Beacon in hazy or rainy weather. At no additional cost this safety feature may result in the saving of a pilot and plane in adverse weather.

CEILING LIGHT — With the spread lens hinged back the unit may be locked at a 45° angle forming a powerful 30,000,000 candlepower Ceiling Light — a valuable aid to safety in night flying, and a necessity at every airport.

THE SPERRY GYROSCOPE COMPANY
BROOKLYN NEW YORK

ANOTHER MANUFACTURER IN THE AVIATION INDUSTRY THAT USES SKF BEARINGS AS STANDARD EQUIPMENT

THE PRATT & WHITNEY AIRCRAFT CO.

Bearing Reliability is Certain when the Highest Priced Bearing in the World is Used

MAN-MADE "wasps of the air" which must function under adverse conditions without ever a thought of failure! Such demands inevitably led to the choice of SKF Ball Bearings for the Pratt & Whitney Wasp motors on fighting planes.

From 800 to 1900 R. P. M. in four-fifths of a second! That is all it takes for the Wasp motor to accelerate and develop 425 H. P. Passing all Government acceptance tests also puts the stamp of approval on SKF Ball Bearings. The highest priced bearings in the world make no compromise with "good enough" where successful operation depends on the reliability of mechanical equipment.

You men who plan, build, use or pay for machines of any kind, remember this: It costs more to replace a poor bearing than to buy the best one that SKF ever produced. AND SKF ANTI FRICTION BEARINGS ARE THE HIGHEST PRICED IN THE WORLD.

SKF INDUSTRIES, INCORPORATED, 40 East 34th Street, New York, N. Y. 1995

Ball Bearings ~ Roller Bearings

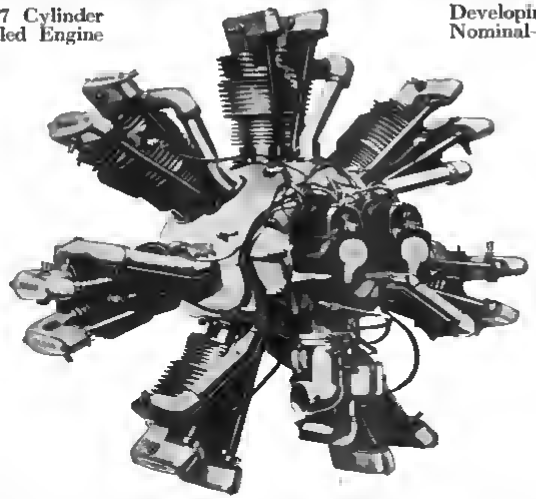
Nothing is apt to cost so much as a bearing that cost so little

SKF

FLOCO
AVIATION ENGINES

Floco-A-7-R a 7 Cylinder Radial Air Cooled Engine

Developing 150 H. P. at Nominal—1800-R. P. M.



Transporting passenger pay loads from port to port in perfect comfort and safety on strict, schedule time is standard performance for Floco Aviation Engines. Yet, Floco exceeds its own standards releasing, at the pilot's will, a rush of reserve power that carries the Floco powered ship through every condition peculiar to aviation.

Produced at a surprisingly modest cost, Floco is a revelation in quality motor construction. Engineered along the most conservative, approved lines, yet embodying modern motor refinements, Floco presents many exclusive features such as compensating rocker arms maintaining a given tappet clearance regardless of motor temperature—pressed aluminum cooling fins on cylinder barrels—cam rollers carried in roller arms relieving tappets of all side thrust—push rod housings and other accessories placed on the rear side of the motor reducing wind resistance to the minimum. Floco engineers have selected only the best, approved accessories for this power plant. Builders of commercial planes will find in Floco a motor exceeding their most rigid specifications.

COMPLETE SPECIFICATIONS AND PRICES ON REQUEST

FRANK L. ODENBREIT, INC.

138 West Seventeenth Street - - - Los Angeles, California

The Vought "Corsair" adopts BENDIX Wheels and Brakes

This remarkable high-performance 2-seater, standard-equipped with Bendix Wheels and Brakes, has been recently chosen by the United States Naval Air Service as its standard convertible type observation—fighting airplane.

The greatly increased controllability made possible by Bendix-Laddon Wheels and Bendix 2-Shoe Servo Brakes has won instant approval from leading aviation engineers; based on these outstanding advantages—

perfect streamline — *high efficiency*
unusual strength — *light weight*
precision-workmanship — *water-tightness*

Now in production in all standard sizes

Approved by
ADVANCE AIRCRAFT
BOEING AIRPLANE COMPANY
CHANCE-VOUGHT CORPORATION
CONSOLIDATED AIRCRAFT CORP.
CURTISS AIRPLANE & MOTOR CO.
THE DOUGLAS COMPANY
FAIRCHILD AIRPLANE MFG. CORP.
GLENN L. MARTIN COMPANY
TRAVEL AIR MANUFACTURING CO.
UNITED STATES ARMY AIR CORPS.

(Fully protected by patents and applications in U. S. and abroad)

BENDIX BRAKE COMPANY
General Office and Plant: South Bend, Indiana
Division of Bendix Corporation, Chicago

BENDIX 4 BRAKES
FOR SAFETY

JUST SRB Ball Bearing Number 213, that's all; right out of regular stock; nothing "hand-picked" about it—built like thousands of other SRB Bearings yet it had been given the hardest known durability test when we decided to examine it.

After it had served 1569 grueling hours on a Pacific Air Transport Plane SRB Engineers took it off for inspection and found it in perfect condition. It ran as smoothly and quietly as a new bearing... it was as tight as one that had never seen service. All that after 1569 hours absorbing the terrific propeller thrust of a Wright Whirlwind Engine. It's going back into the same place for further service.

Such is the performance of SRB Ball Bearings in aircraft engines—which is why you find them in Wright, Curtiss, Pratt & Whitney and other engines.

Our slogan is again confirmed—

USE SRB BALL BEARINGS—*First!*
—they'll last

STANDARD STEEL AND BEARINGS INCORPORATED
Plainville *Connecticut*

Ball SRB Bearings

CESSNA
WICHITA KANSAS

In the Spotlight

As far in advance as a 1928 "Straight-8" over a bicycle.

—entirely new structural design, from prop to rudder,

—speed far in excess, per motor horse-power, of any other cabin ship,

—take off in less than 75 feet, climb to 1,000 feet in 26 seconds,

CESSNA CANTILEVER CABIN MONOPLANES are truly "In The Spotlight."

Motor for motor, they'll out-climb, out-perform, out-fly any cabin plane yet developed.

They'll also OUT-SELL, in the hands of a progressive dealer.

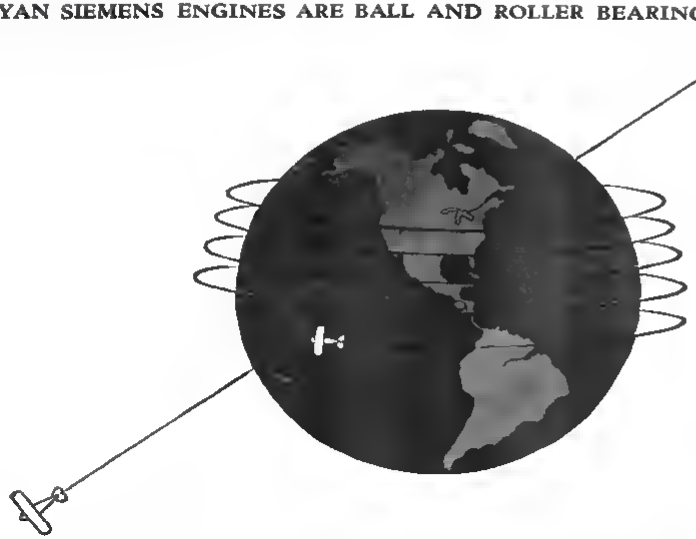
They offer an unequalled sales opportunity for the *right* dealer.

If you think you are the man, wire us quick for full details of our dealer plan

Open territories are fast being taken up—don't delay.

Cessna Aircraft Company
Wichita, Kansas

RYAN SIEMENS ENGINES ARE BALL AND ROLLER BEARING THROUGHOUT



Ryan Siemens 5-Million Mile Motor *is Now on Display* at the Detroit Show

FIVE million miles is a tremendous distance, it represents two hundred complete journeys around the earth at the equator. Yet five million miles is the distance that has been flown by the Ryan Siemens aviation motors under strictly work-a-day world conditions. This achievement does not include thousands of miles flown in tests and experiment. These five million miles represent the performance of the motors over twelve commercial air lines in Europe.

While piling up this stupendous mileage the salient features of the Ryan Siemens motor were proven. Its builders knew, but the world was skeptical, now the world knows what Ryan Siemens performance means. Its steady, sure power, its dependability and economy are now facts.

It is a remarkable fact that many of these wonderful engines fly 400 hours without a valve grind. They are asked to keep swift schedules between the capitals of Europe, often under the most adverse conditions. Now Ryan Siemens dependability is taken for granted. The proof is positive, the problem solved, success, safety, and endurance assured. For detailed information address,

RYAN

RYAN AERONAUTICAL CORPORATION

San Diego, California

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Commerce follows the pioneer

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World-Famous Trans-Atlantic Pilot

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Hinton and H.R.H.

This photo shows Lieutenant Hinton describing the flight of the NC-4, of which he was pilot, to the Prince of Wales. As a pilot, Hinton ranks among the country's few. And as an instructor he represents a combination impossible to beat—long experience, painstaking study and a natural ability to make things clear to others.

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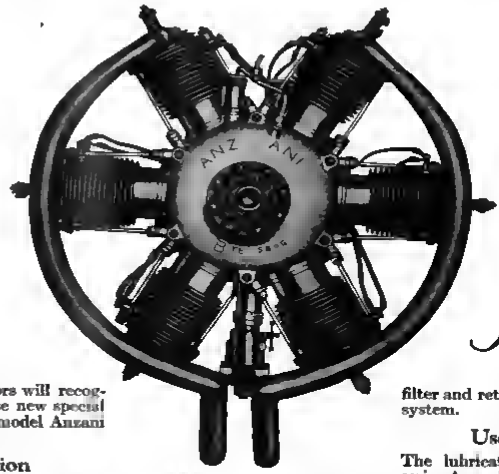

SEE the new Anzani *in these airplanes:*
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Cessna Davis
Driggs-Dart Wallace
At the
ALL-AMERICAN AIR CRAFT SHOW *at*
Detroit, April 14 to 21

PILOTS and operators will recognize the value of these new special features of all the 1928 model Anzani Engines—

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Two separate high tension magnetos, each serving all cylinders—two spark plugs per cylinder. Magnetos are the highest type of modern design and located in a well-protected but easily accessible position at the rear of the crankcase.

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A positive acting gear pump supplies an unfailing flow of lubricating oil to all working surfaces—oil slingers on shafts prevent leakage and insure economical distribution. A separate scavenge pump is provided which draws the oil through a filter and returns it to the distributing system.

Uses mineral oil

The lubricating system of the new series Anzani is especially adapted to use mineral oil—"Mobile B" recommended. This means that proper oil may be obtained easily anywhere in the United States as well as in most foreign countries. Due to the high operating efficiency of the oiling system, the consumption of oil is low—only .02 lbs. per horsepower per hour.

These and many other improved features of the new Anzani assure the utmost in economy and dependability of operation for all requirements of from 18 to 120 B. P. We will be glad to furnish complete specifications. Let us know your requirements.

The following stock 1928 models of the Anzani Engine give a power plant range to meet the requirements of light commercial airplanes

Rated H. P.	Normal r. p. m.	Weight (lbs.)	No. of cylinders	Bore (inches)	Stroke (inches)	List Price
35	1700	116	3	4 1/8	4 7/8	$735
50	1700	133	3	4 5/8	4 7/8	1325
80	1650	214	5	4 1/8	4 7/8	1650
120	1550	320	10	4 1/8	5 5/8	2170

The prices quoted are for Engine complete, including magnetos, carburetor and exhaust collector ring

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The Oldest American Aeronautical Magazine

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AVIATION

The Oldest American Aeronautical Magazine

Vol. XXIV *APRIL* 16, 1928 No. 16

The Detroit Show

DETROIT IS this week staging an aircraft exhibition which differs essentially from any other indoor exhibition which has ever been held. Previous exhibitions have been promotion schemes, with a preponderance of military planes and little emphasis on the direct sales. They have been for purposes of good will with but little expectation of direct results. The Detroit Show on the other hand, is primarily a commercial show. It is a sales outlet such as is used by other well established industries. The hearty response of commercial manufacturers to Detroit's efforts indicates that they believe it to be commercially sound. They feel that the public is ready to buy and not merely to look at airplanes. They feel that it is necessary for the large number of dealers and distributors throughout the country to be able to see the products of the various manufacturers assembled under one roof. They feel that their engineers will be stimulated by seeing the progress made by others.

The crowds which visit the Show cannot fail to be impressed by the substantial progress that has been achieved. More than forty companies are exhibiting commercial planes and many of them are showing several models. These planes are practical money-making vehicles and are being produced in quantity. Whether a man is interested in a sport plane or an air liner, he will find it at the Show. The planes and accessories which can be seen under the roof of the Detroit Convention Hall reveal that a strong and flourishing industry has arisen. Those who are dubious of the achievements of commercial aviation in America could not have a better demonstration of what has already been done.

There is no doubt of the value and effect of an indoor show as it can be much more easily reached by the general public and there are many who will attend it who would not bother to go to a flying field which was located a long ways out of town. However a word of warning might not be amiss. The Show is good advertising but it is also expensive. Many other cities will undoubtedly try and promote shows of their own and though admitting their public value the cost to the industry must also be considered.

The Twentieth Century

ALTHOUGH WE deplore the rashness of the attempted Atlantic flights and wish that they were not to be made, none the less, we are forced to admit that there is a certain epic quality in these foolhardy attempts. In the Biblical days champion warriors battled while the hostile hosts looked on. Later the Roman populace looked on while the gladiators fought in the arena. Medieval Europe had its knights who met in single combat. Today the nations send forth their airmen to do impossible feats with the whole world as their audience.

America won the glory of the flight from West to East and Europe answered the challenge by sending out their champions on ill fated voyages. Nothing daunted by the apparent impossibility of the task England, Germany and France are preparing further attempts. With the lapse of time the history of the twentieth century will become blurred but there will remain a legend of heroism and romance such as has rarely been told.

Commercial Aircraft Development

ALMOST A quarter of a century has elapsed since man first flew successfully in a power driven airplane. During that period enormous progress has been made. The flimsy and unreliable plane in which the Wrights first wobbled into the air has been developed until it can be relied upon to cover enormous distances at tremendous speed. Outside of the work done by a few sportsmen and exhibition fliers, this development was carried on until after the war entirely under government supervision and with government funds. For several years after the war, planes designed primarily for military purposes were used almost exclusively in commercial work.

It can never be exactly determined when commercial aviation began to be weaned away from military independence, but by 1923 or 1924 the commercial operation of aircraft began to be put on a business basis. The gypsy pilot was becoming a fixed base operator and the air mail started its night flying and its continued carriage of mail over long distances. It was realized that planes designed for civilian use could be operated more economically than the cheap war surplus planes and we began to have successful manufacturers who catered only to the civilian users. The growth of sound commercial aviation was very gradual at first but has been going on steadily at an ever increasing pace.

Governmental development has produced great results but in all other lines of endeavor civilian enterprise has soon outstripped it. When it is considered that commercial aviation is really less than five years old, the results accomplished, as shown at the Detroit Convention Hall, are really remarkable. It must also be remembered that until a year or a year and a half ago aircraft enterprises could not look to bankers for financial assistance. With aircraft unfettered from military limitations and with the financial resources of the country behind it, the industry can look forward to even more rapid progress than has been made in the past few years.

Airplane Division

Brief Descriptions of the Exhibits in this Division that Includes Landplanes, Seaplanes and Amphibians

Attention is called to the fact that the descriptions of the exhibits in this Division, as well as those in the Engine Division and the Accessory and Equipment Division are in alphabetical order. This has been done not only because it amplifies reference, but also because we feel that every exhibit is of interest and that favoritism should not be shown to any particular one . . . The Editor.

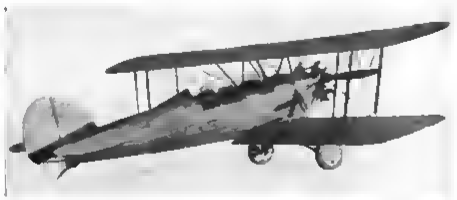
ADVANCE AIRCRAFT CO.

Troy, O.

The display of the products of this company covers 4,375 sq ft. of floor space and is in the charge of the Knepp Flying Service, Ypsilanti, Mich., distributor of Ryan and Waco planes. Five Waco planes are being shown as well as various types of new production engines which are now available.

Of particular interest is the Waco 10 powered with a 125 hp Ryan-Siemens radial air-cooled engine which is being shown for the first time in public. This plane has a Berryloid finish consisting of Queen Grey cowling and Viceroy Ivory fuselage. The wings have the usual aluminum finish. The struts and wires are nickel plated and the plane is equipped with a Special Consolidated Instrument Panel, electric starter and a Hamilton metal propeller.

A Waco-Whirlwind is also being exhibited. It has block fuselage and cowling with wings of orange. It is equipped



Rear quarter view of the Waco 10 fitted with a Fairchild Cummax engine.

with Bendix brakes, navigation lights, Special Consolidated Instrument Panel and Hamilton Metal propeller. This combination was awarded Airworthiness Type Certificate No. 13.

The Waco fitted with a Fairchild-Cummax engine on exhibition at this booth is finished in two tones of Berryloid red on the fuselage and cowling. The struts and wires are nickeled and the wings are finished in the usual aluminum color. A Special Consolidated Instrument Panel is included.

Two Wacos powered with OX-5 engines are also included in the exhibit. One is fitted with a set of Edo De Luxe pontoons, converting it to a seaplane. The rest of the equipment is standard. The other Waco-OX-5 has a special Berryloid finish, nickled struts and wires and a Special Consolidated Instrument Panel. The cowling is finished in Acadian Blue and the fuselage in Baltimore Grey. The wings are finished in the usual aluminum color.

Knepp Flying Service, Inc., is also exhibiting in this booth one Ryan Brougham. It is a standard B-1 model powered with a Wright Whirlwind. It is fitted with each equipment as two full width doors, wheel brakes, cabin heater, navigation

Side view of the Waco 10 fitted with a 125 hp Ryan-Siemens engine.

lights with battery and dash lights, wind shield wiper, Eclipse hand starter and a full set of instruments.

One Monocoupe powered with an Anzani engine is also a part of the exhibit. This plane is manufactured by Moan Aircraft Inc., Moline, Ill., which company recently took over the Central States Aero Co. Mono Aircraft, Inc., is a subsidiary of the Velie Automobile Co.

Further details of the planes being exhibited will be found in the Commercial Airplane and Seaplane Specification Table published elsewhere in this issue. Further details of the engines mentioned will be found in the Commercial Engine Specification Table, also printed elsewhere in the issue.

Edward O. Knapp is officiating at this exhibit and the officers of the Advance Company who are in Detroit during the Show include C. V. Bruckner, president, R. E. Lees, sales manager, Charles W. Meyers, chief test pilot, and E. P. Green, chief engineer.

AERO CRAFT MANUFACTURING CO.

Detroit, Mich.

In a display area of 1200 sq. ft. this company is exhibiting its new "Aero-Coupe". The Aero-Coupe is a three place semi-cabin biplane, powered with a 110 hp Warner air-cooled radial engine. The plane is rated at a top speed of 110 m.p.h. and a cruising speed of 100 m.p.h. The cabin which is built to accommodate two passengers comfortably is fitted with a 26 in. door, and a sliding hatchlike roof which opens to provide easy entrance or exit. The seats are low and are set at a comfortable angle. The dimensions of the cabin are: height 42 in., length 50 in., width 36 in. clear. By removal of the seats the plane is then suited for mail or express carrying. One of the marked features is that the plane is easily and quickly convertible for training purposes. The span of the upper wing is 32 ft., and the lower wing 28 ft. The overall length is 22 ft. 8 in.

The fuselage, empennage and ailerons are of welded tubular steel construction. Conventional wood construction is used in the wing. The rudder and ailerons are counter-balanced and the stabilizer is adjusted from the pilots' cockpit. The tail skid is equipped with Oleo shock absorber and the plane is finished in attractive color combinations of Berryloid lacquer. The standard brake and wheel equipment is Bendix, and the wheels work on Timken Roller Bearings. The control is stick and rudder, and the cockpit is equipped with group unit instrument board indirectly lighted and includes in addition to engine gauges, a tachometer, altimeter, air speed indicator and compass. Capt. Clement W. Brown, president of the company is in charge of the exhibit.

AMERICAN EAGLE AIRCRAFT CORP.

Kansas City, Mo.

The exhibit of this company covers 2,000 sq. ft. of floor space. Two planes are being exhibited; one an American Eagle powered with an OX-5 engine and the other an American Eagle powered with a Quick air-cooled radial engine. The standard American Eagle is a three place, open cockpit biplane with two passengers seated in the front cockpit and the pilot in the rear. The fuselage is of welded steel construction forming a Warren truss, with no wires, and a wood

Front quarter view of the American Eagle powered with an OX-5 engine.

turtle deck. The OX engine is completely cowled and the radiator is underslung. The wings are of wood and are fabric covered. It has welded steel tube tail surfaces and balanced rudder and balanced ailerons. It also has a split type landing gear. The span is 30 ft., the length 24 ft. 8 in., the height 8 ft. 4 in., and the wing area is 300 sq. ft. Empty the plane weighs 1275 lb., and loaded it weighs 2750 lb. The top speed is 110 m.p.h., cruising speed 85 m.p.h., and the landing speed 30 m.p.h.

Complete specifications of the plane will be found in the Commercial Airplane and Seaplane Table and complete specifications for the two engines will be found in the Commercial Engine Table. This plane was described in detail in the June 6, 1927, issue of AVIATION.

ALEXANDER AIRCRAFT CO.

Denver, Colo.

In a display of 4500 sq. ft. this company is exhibiting three Eaglerock planes, each powered with a different type of engine, one a Ryan-Siemens 125 hp., one a Menasco 260 hp., and one a Wright Whirlwind 225 hp. The new Eaglerock was designed primarily for new radial air-cooled engines. By the installation of a detachable engine mount, the present Eaglerock can accommodate any engine up to and including a Wright Whirlwind J-5 with a load (safety factor) of 8 plus. This load factor has been increased with no increase in weight due to careful design. The fuselage is of chrome molybdenum steel tubing in the form of a Warren truss, and the engine mount is detachable at the fire-wall. A 46 gal. gasoline tank is in the fuselage. The wooden wings which are fabric covered are made up of laminated I beam spruce spars and built up spruce ribs; double wire bracing is used internally except beyond the interplane struts where single wires are used. Haskelite plywood is used throughout. The plane is fitted with an adjustable stabilizer and the wings are wired for navigation lights. A split axle type of landing gear is used. The span of the upper wing is 36 ft. 8 in., and the wing area is 330 sq. ft. The gross weight with any of the three engines mentioned is 2230 lb. Fitted with a Ryan-Siemens engine the high speed of the plane is 112.8 m.p.h. Fitted with a Whirlwind the high speed is 135.3 m.p.h. The landing speed with either a Ryan-Siemens or Wright Whirlwind is 34 m.p.h. With a Ryan-Siemens engine the plane climbs 830 ft. per min., and with a Wright Whirlwind it climbs 1554 ft. per min. Further specifications of this plane will be found in the Commercial Airplane and Seaplane Specification Table. J. A. McInaney is in charge of the Alexander Aircraft exhibit.

Rear quarter view of the Alexander Eaglerock fitted with a 125 hp. Ryan-Siemens engine.

ATLANTIC AIRCRAFT CORP.

Hasbrouck Heights, N. J.

This company, which is a subsidiary of the Fokker Aircraft Corp. of America of Wheeling, W. Va., is exhibiting its new Fokker Super-Universal powered with a Pratt & Whitney 400 hp. Wasp engine. The company is displaying in 3,000 sq. ft. of floor space. The Super-Universal was developed from the well-known Whirlwind engined Fokker Universal. The Super-Universal, however, is somewhat larger than the other model. The wing is of full cantilever construction and covered with wood veneer. The span is 50 ft., 6 in., the maximum chord 10 ft., the wing area 388 sq. ft., and the maximum height is 8 ft. 11 in. The powerplant which is

Front quarter view of the new Fokker Super-Universal powered with a Wright Whirlwind engine.

the Wasp engine is complete with tool kit, carburetor, heater and double exit manifold with silencing end. There is no Eclipse inertia starter, booster, magneto, and Standard Steel metal propeller. The fuselage is of welded tubular construction of specification 10,225, low carbon steel, rust proofed and offering maximum strength with ease of repair. It is of War-

Continued on page 1074

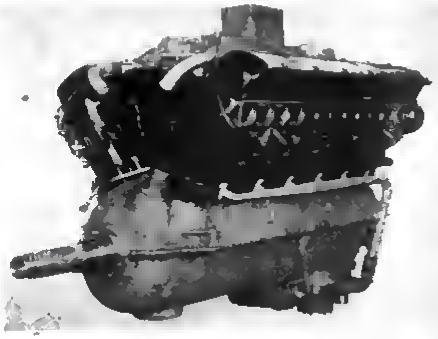
Engine Division

Some Details of the Displays in this Division that Contains both Air Cooled and Water Cooled Power Plants

CURTISS AEROPLANE & MOTOR CO., INC.

Garden City, L. I., N. Y.

The total exhibit of this company covers 200 sq. ft. of floor space. The engine exhibited is the Curtiss "Conqueror" V-1550. It is a 12 cylinder V type water-cooled 600 hp. engine developed from the Curtiss D-12. It has the same frontal area as the D-12 and although it develops considerably more power, it is only slightly heavier. It weighs 760 lb dry or



Front quarter view of the Curtiss "Conqueror" V-1550 engine

1.26 lb. per hp., whereas the D-12 weighs 680 lb. and develops 435 hp. The engine has been under development for the last three or four years and during that time the Curtiss Co. was in production on a 1400 cu. in. engine of the same bore and stroke as the Conqueror which is 5½ and 6¼. The Conqueror has a displacement of 1569 cu. in., and a compression ratio of 5.8.

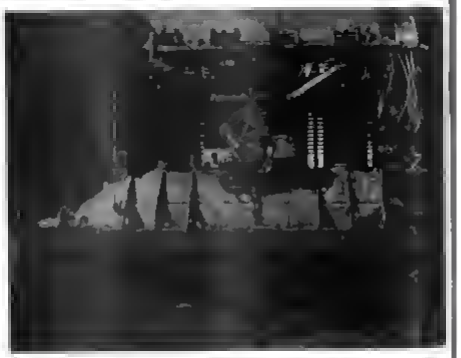
It is also built with reduction gears and weighs only 90 lb. more. The geared engines were those installed in the Curtiss Condor, a twin engine bomber. The Conqueror which heretofore was purely a service type of engine is now available for commercial use. One is being installed in a Curtiss Falcon belonging to the Curtiss Flying Service. A V-1550 engine was installed in a Curtiss Hawk pursuit plane which won the Free For All Military Pursuit Race at the 1927 Air Races, at a speed of 201.2 m.p.h. That plane had wing radiators. Another similar model fitted with the usual tunnel type radiator finished second at 180 m.p.h. In the Observation Plane Race two Curtiss V-1550 engines finished first and second at speeds of 170 and 162 m.p.h., respectively. This engine was described in detail in the issue of March 7, 1927, of AVIATION. Further specifications will be found in the Commercial Engine Specification Table.

DAYTON AIRPLANE ENGINE CO.

Dayton, Ohio

The exhibit of this company which covers 100 sq. ft. of floor space is featured by the showing of the Dayton Cub, a four cylinder in line air-cooled, built with latest type of aluminum alloy cylinder head on a nickel iron cast cylinder. The Dayton Cub is at present rated at 110 hp. at 1550 r.p.m., but it will develop a higher hp. at higher r.p.m. The bore is 4.5 in, the stroke is 7.0 in., and the compression ratio is 5.3. Without propeller or hub the complete engine weighs 375 lb. It is fitted with double magnetos and carburetor as standard equipment.

The engine is built rugged with a view to endurance and low maintenance costs. An additional drive unit has been provided which will drive either a C-5 fuel pump or gear oil pump or both. This takes care of plane builders who want a fuel pump or a dry sump engine. Conversion to a dry sump engine necessitates only adding the pump or changing from 1-2 external pipes on the crankcase. Full force feed lubrication is provided to all plain bearings in the engine, while the ball bearings are oil sprayed. The crankshaft is 5ve bearings of sturdy construction and is held in place by babbitted steel backed main bearings which in turn carry their load



Side view of the Dayton "Cub", a four cylinder in-line engine rated at 110 hp at 1550 r p m.

through to the cylinder head by long through bolts which clamp the cylinder heads on the cylinders. The seal is made by metallic gaskets. Construction permits of easy removal of cylinder heads for construction or grinding. The overhead valves are seated in aluminum bronze seats and two diametrically opposed spark plug openings directly below the valves are also bronze bushed. The overhead camshaft and housing which serve to hold the cylinder heads en-bloc are similar in construction to that used in the Liberty engine. The aluminum crankcase carries all mountings in the upper half. The oil pump is located in the sump. Baffle plates are inserted above the oil. The Dayton Cub is adaptable either as a tractor or pusher without change, as a double ball thrust bearing is provided at the propeller end.

Further specifications will be found in the Commercial Engine Specification Table.

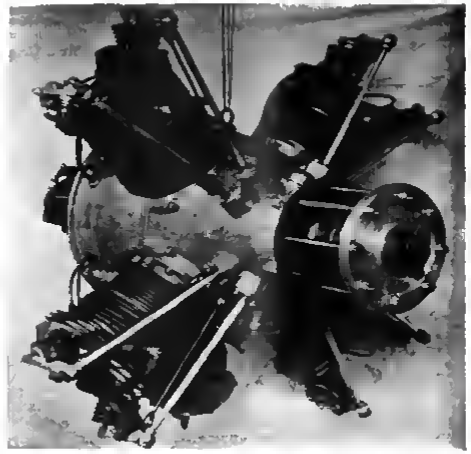
R. R. Grant and M. H. Simmons are in charge of the exhibit.

FAIRCHILD CAMINEZ ENGINE CORP.

Subsidiary of the Fairchild Aviation Corp.

Farmingdale, L. I., N. Y.

This exhibit contains the Fairchild Caminez engine, a four cylinder radial engine that is rated at 135 hp at 1,000 r.p.m., and develops 140 hp. at 1050 r.p.m. The engine weighs 350 lb., or 2.5 lb. per hp. The displacement is 447 cu. in., and



Front quarter view of the 135 hp Fairchild-Caminez engine

the compression ratio is 5 to 1. The engine has no crankshaft and instead uses a double lobed cam in contact with rollers. The pistons are linked together and the camshaft turns at one-half ordinary crankshaft speed allowing a very efficient low speed propeller of large diameter. The engine on display is sectionalized to show the internal parts. An article by D. R. Caminez describing the engine in detail appeared in AVIATION, Sept. 12, 1927.

R. K. LEBLOND MACHINE TOOL CO.

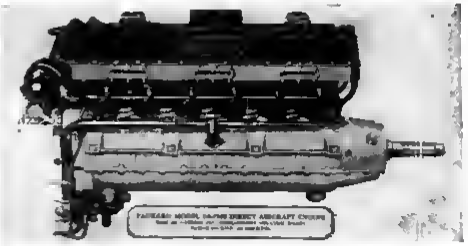
Cincinnati, Ohio

The feature of this exhibit which covers 200 sq. ft. of floor space is the showing of LeBlond 60 air-cooled radial engine. The engine which is of five cylinder design was developed from the Detroit Air-Cat engine and is very similar to that engine except that it has enclosed valves. The engine develops 60 hp., and the officials of the company state that they are going into production on a three cylinder engine of 40 hp., and a seven cylinder engine of 90 hp. One of these engines being exhibited at the Show is in the J.B.S. "Arrocupe" exhibited by the Stinson School of Aviation. The main dimensions of the Air-Cat were bore 4½ in., stroke 3¾ in., displacement 250 cu. in. It develops 60 hp. at 1800 r.p.m.

PACKARD MOTOR CAR CO.

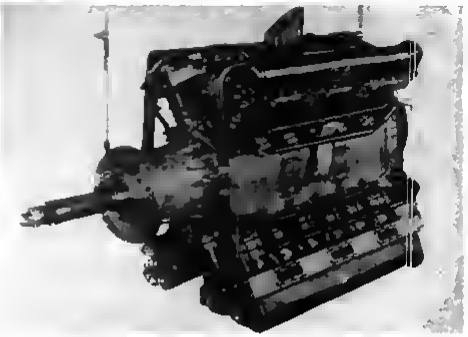
Detroit, Mich.

In a display area comprising 400 sq. ft. of floor space this company is exhibiting five aircraft engines; the Packard X engine, the Packard 1500 direct, the Packard 1500 inverted, the



Side view of the Packard 2A-1500.

Packard 2500 direct, and the Packard 2500 geared engine. The Packard X engine was designed and built primarily as a powerplant for the racing plane built for Lieut. A. J. Williams, U.S.N. It develops 1250 hp. at 2500 r.p.m. Two engines of this type have been built by Packard; the second is equipped with a super-charger which gives it 1500 hp. at 2500 revolutions. Lieutenant Williams' engine was described



Front quarter view of the Packard 1250 hp. X engine used by Lieut Al. Williams.

in detail in the Aug. 15, 1927, issue of AVIATION. The Packard 1500 direct drive engine which is used in Boeing pursuit planes built for the United States Navy develops 600 hp. at 2500 revolutions. The inverted engine is the same engine designed to run up-side-down and is being used in a large number of Loening amphibians operated by the Navy.

The Packard 2500 direct engines develop 800 hp. at 2000

Continued on page 1070

Accessory *and* Equipment Division

Short Accounts of the Many Exhibits that Feature this Division

AC SPARK PLUG CO.

Flint, Mich.

The main feature of this exhibit which covers 150 sq. ft. of floor space is the AC Fuel System for airplanes. The exhibit also contains artistically designed airplane instrument board panels in which are installed AC tachometers, oil gauges, thermogauges, and ammeters; and a full line of AC spark plugs which include type N, the same plug used by Lindbergh, Chamberlin, Byrd, Maitland, Brock and Schlee, and other famous fliers.

The AC fuel pump on exhibition differs from the type used by the government in that it is a diaphragm pulsating pump, a self priming device. The diaphragm is composed of several layers of especially treated flexible cloth material which is

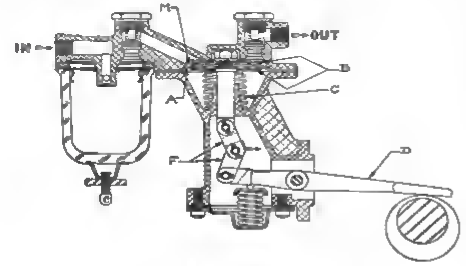


Fig. 1. Drawing of the AC Fuel System.

absolutely impervious to gasoline and benzol. This cloth material (Fig 1., A) is held between two metal discs (H) and is pushed upward by a spring (C). This diaphragm in its upward position almost fills the pump chamber (M) so that in its downward movements a very high vacuum is obtained, thus assuring high pumping capacity even at low speed. The repeated ¼" movement of the diaphragm is possible indefinitely without any injury due to the flexibility of this material. The extreme movement of the diaphragm occurs only when the carburetor is empty. When full this movement is greatly diminished. In practically all normal engine running conditions the diaphragm is pulsating in a movement of a few thousandths of an inch. The movement is controlled by linkage (F) because when the diaphragm is in the depressed position due to sufficient fuel in the carburetor the reciprocal movement of the lever (D) will merely cause a movement of the linkage (F) to the right as shown by the arrow.

The AC fuel pump which weighs less than three pounds and does not affect engine carburetion at any speed is stated to be mechanically reliable, quiet, and economical in the cost of both the unit and the fuel system installation. For airplane use the AC Spark Plug Co. now has under development a large capacity fuel pump made of alloy steel and magnesium which supplies sufficient fuel for a 500 hp. engine and weighs complete less than two pounds. No duplication of pipes is required with the AC pump fuel system and the pump unit includes a strainer with a glass bowl to collect any water and sediment that may be in the gasoline. David Gregg, AC research engineer, is in charge of the exhibit.

AIRSHIPS, INC.

Hammondsport, N. Y.

This exhibit which covers 50 sq. ft. of floor space contains models of the company's products, pneumatic boats for airplanes. These air rafts are manufactured in three different sizes, the "Soloraft" for pursuit and single place planes; the standard "Airaft", and the "Superaft" for use in large planes carrying a crew of five or more.

Deflated these rafts can be folded and carried in a small space. For inflation air or carbon dioxide gas is usually used. They can, if desired, be equipped with bottles of carbon dioxide gas for rapid inflation. Flightex is used entirely in the construction of these rafts.

AEROMARINE STARTER CO.

Keyport, N. J.

This company is exhibiting in 100 sq. ft. of floor space three of its type D Starters. Type DU incorporates a universal transverse bevel cranking attachment. It is also equipped with a universal joint giving 30 deg. angular latitude in plan aspect to permit easy avoidance of interferences with struts, etc. It is standard Navy equipment on the Wright 1750 engine such as is installed in the twin engine PN flying-

Type "D" Aeromarine starters. Left, "DL", center, "DE", and right, "DU".

boats where it permits right and left hand installation. Type DL has a longitudinal attachment to permit cranking from the cockpit in tractors. It is standard equipment on the Pratt and Whitney Hornet engine as installed in the new Martin planes. Type DE has a special form of electric motor incorporated in the flywheel giving extreme compactness and effecting a great saving in weight with the result that the combined hand and electric machine of 750 ft. lb. torque capacity, which is sufficient for all aircraft engines up to 800 hp., weighs only 30 lb. The other two types weigh 24 lb. each.

All three machines are characterized by their extreme free running, permitting high flywheel speed and energy capacity without exhausting the operator. A 10 min. free rundown is the minimum required for new production machines and recently the officials of the company obtained 19½ minutes on a machine which had received 100 locked jaw tests under official Navy supervision. It is stated that this advantage is not sacrificed in any way by the new electric attachment, 15 min. being the rundown obtained on the first combined hand electric machine. Roland Chilton, chief engineer of the company, is in charge of the exhibit.

AERO MODEL PRODUCTS CO.

Chicago, Ill.

In a display area of 100 sq. ft. of floor space this company is exhibiting scale model airplanes which resemble real planes in appearance and construction and give satisfactory flying performance. One model which is made of bamboo and is paper covered is known as the Silver Ace. The other is the Silver Ace De Luxe which is covered with varnished silk and is far more durable. Both are monoplanes but an extra pair of wire wing supports have been added to the fuselage of the Silver Ace so that it may be flown as a biplane by adding a second pair of wings. Pontoons are furnished with these models and may be attached to the axles by removing the wheels. The Silver Ace De Luxe has a wing spread of 30 in. and weighs only 3¾ ounces. Power is supplied by eight strands of rubber bands put under tension by a winding device. Propellers, landing gear, wheels, and nose collars are made of semi-flexible celluloid. Wire spring shock absorbers are used. The wings and tail are of hollow construction with accurately shaped ribs covered with varnished silk. Fuselage, sides, and ribs are made of balsa veneer. J. M. Schott and H. F. Coffin are in charge of the exhibit.

AIRPORT ENGINEERING CO.

Detroit, Mich.

The feature of this exhibit, which covers 100 sq. ft. of floor space, is a model of the Grosse De Airport at Grosse De, Michigan, which the Airport Engineering Co. and the owners, the Chateau Voyageurs, and the Aircraft Development Co. are building. The airport when completed will provide a safe port for airplanes, both land and water, and dirigibles.

The model is a true facsimile made from a topographical map and shows the field, which is a 3,000 ft. circle, hangars for airplanes and dirigibles, the seaplane harbor base, the golf course, the club house of the Chateau Voyageurs, and the lagoons about the club property. The exhibit is in the charge of Myron B. Vorse and of Herbert C. Winter, who formed the Airport Engineering Co. in 1925 to act as a clearing house for information dealing with airport construction.

AQUA OIL SERVICE, INC.

New York, New York

The company is exhibiting, in 200 sq. ft. of floor space, equipment for storing and dispensing gasoline and oil at airports and flying fields. This equipment consists of overground equipment of continuous flow, metered systems, with Aqua Nozzle Control for rapid fueling and oiling. A model is being exhibited at this exhibit to demonstrate the principle of operation of the Aqua System. The exhibit also includes photographs, drawings, and sketches showing the application of Aqua gasoline and oil systems for airplane factories. In this connection the company is featuring an automatic dynamometer test room apparatus.

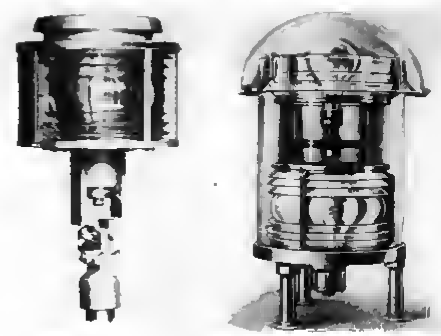
Some of the features of the Aqua Gasoline System for the fueling of planes are: a one man operation; a continuous and rapid flow; control at the nozzle; delivery of fuel without dirt or water; an sweating inside tanks; any number of fueling points on the field; fueling outlets flush with field; everything underground; accurate measuring device at each outlet; absolute check on fuel in storage; an evaporation or deterioration in gravity or volume; every fueling outlet and filling pipe strongly protected and under lock and key; long life and low maintenance cost.

B.B.T. CORP. OF AMERICA

Philadelphia, Pa.

Four of the products of this company are being exhibited in 100 sq. ft. of floor space. They are: the new B.B.T. Intermediate Air Mail Type Landing Floodlight; a B.B.T. type Q-5 Aviation Flashing Beacon, a B.B.T. type PF-8 180 deg. Triple Reflector Floodlight; and a B.B.T. type AF-8 180 deg. Floodlight unit.

The Intermediate Type Air Mail Floodlight was developed for the moderate sized airport because of the objections to a multiple lighting system. It is similar to the large unit



Left, a B.B.T. Type AF-8 Floodlight. Right, a B.B.T. Flashing Beacon Type Q-5.

except that it is somewhat smaller and uses a 5 KW lamp. The housing is constructed of sheet steel, is thoroughly water proof, and is designed to provide ample ventilation for the lamp. A chromium plated spun copper spherical reflector behind the lamp materially increases the unit's efficiency. A 180 deg. 11 element, hand cut Fresnel lens is used. By means of an adjustable base feature the beam can be tilted to the proper angle. This unit can also be mounted on a 4-wheel truck and transported to any part of the field. A landing area of 1500 ft. in length or more can be lighted with sufficient intensity to permit safe landings.

The Aviation Flashing Beacon is provided with a 250 mm. diameter full size 360 deg. Fresnel lens surmounted by a half lens of the same diameter each lens having a 1500 watt lamp. An intense beam is projected over the entire 360 deg. in the horizontal plane. The rays emitted by the upper half of the top lamp produce a dome of light making the beacon visible when the approaching pilot is above the concentrated beam.

Continued on page 1042

Materials *of* Construction

Stress Analysis of Commercial Aircraft, Chapter Number Six

By PROFESSOR ALEXANDER KLEMIN
Daniel Guggenheim School of Aeronautics

And GEORGE F. TITTERTON
Late of the Bureau of Aeronautics, Navy Department

WHEREVER IN the airplane structure a pure tension load must be taken the most efficient way of taking it is with a steel wire. Wires are used in wing and drag trusses, tail bracing, fuselage construction, and for operating controls. In some cases the wires are exposed—in which case streamline wire is often used—and in other cases they are internal as in drag truss. In any case the wire that best fits the situation is the one that should be used.

Wires may be classified into hard, stranded, and tie-rods. The hard wire is a single strand of high tensile strength steel; the stranded wire is a miniature cable made up of a number of small strands twined together; tie-rods are single strands with threaded ends and come with cross-sections that are round, square, or streamline. The streamline form is for external use where it gives a minimum resistance.

Hard wires are now forbidden for use as a structural part of airplanes built for the Army and Navy. Commercial operators still use them extensively for bracing of drag trusses and tail surfaces. The properties of hard wire are given in Table 8. There are several reasons why the Army and Navy object to the use of hard wire. In the first place they are but a single strand which may snap without warning after or during a period of excessive strain. Secondly the method of making end connections weakens the wires anywhere from 15 to 40 per cent. depending upon the skill of the workman; bending the end of the wire through 180 degrees to form a small loop and then soldering a ferrule close to this point to make the joint secure destroys the properties of the wire. The high strength is originally obtained by cold-working and the heat of soldering and the strain of bending through such a large angle destroys this strength.

For the reasons just given it is advisable to allow at least a 15 per cent. reduction in the strength of this wire as listed in Table 8. It is also important to inspect the loops after soldering to see that there are no cracks present. Unless the ferrule is well soldered there will be slippage at the joint which will cause slackness in the wire. This in serious as these wires have no provision for tautening. In general it is not advisable to use these wires as the saving in weight is not comparable to the added hazard of failure under load.

Table 8.
Properties of Hard Wire

Steel Wire Gage	Diameter in Inches	Weight per 100 ft. Pounds	Breaking Strength Pounds
0	0.306	98.57	14,800
1	.283	81.14	12,100
2	.252	18.29	10,420
3	.244	15.71	9,250
4	.225	13.85	7,850
5	.207	11.01	6,450
6	.192	9.73	5,030
7	.177	8.27	5,250
8	.162	6.99	4,320
9	.148	5.78	3,850
10	.135	4.81	3,250
11	.120	3.80	2,970
12	.109	2.91	2,090
13	.091	2.23	1,800
14	.080	1.69	1,260
15	.072	1.07	1,040
16	.062	1.16	775
17	.054	.770	600
18	.047	.593	480
19	.041	.448	805
20	.034	.325	290
21	.032	.275	220

Continued on page 1034

Table 9.
Strength of Steel Cable

Diameter in Inches		Non-Flex. 19 strands Weight in lb. per 100 ft.	Non-Flex. 19 strands Breaking Strength Pounds	Flexible 7x7 Weight in lb. per 100 ft.	Flexible 7x7 Breaking Strength Pounds	Extra-Flex. 7x19 Weight in lb. per 100 ft.	Extra-Flex. 7x19 Breaking Strength Pounds
0.031	1/32	0.50	185				
.062	1/16	0.78	800	0.81	480		
.078	5/64	1.21	750	0.83	580		
.094	3/32	1.75	1100	1.46	950		
.109	7/64	2.60	1600				
.125	1/8	3.50	2100	2.45	1350	2.88	2000
.156	5/32	5.50	3200	4.57	2500	4.64	2800
.187	3/16	7.70	4600	6.80	3200	6.47	4200
.218	7/64	10.00	6100	8.50	4600	9.80	5600
.250	1/4	13.60	6000	10.60	6600	12.00	7000
.281	9/32					16.66	8000
.312	5/16	20.65	12600	16.70	9200	17.71	9800
.344	11/32					22.53	12500
.375	3/8					56.45	16400

The Problem *of* Combating Ice Accumulation

By C. G. ANDRUS
Hadley Airport
U. S Weather Bureau, New York, N. Y.

Introduction

THIS PAPER deals with a subject about which next to nothing has been written, slightly more been studied and generally ignored as of only occasional importance. Ice however ranks first as the terror of wintertime air. It is protested at the outset that this treatment of the subject presented herewith is neither final nor complete. It is published for the purpose of encouraging further study and to present such facts as have been our great privilege to gather during the past two winters as we have listened to the fantastic and heroic accounts of battles with ice from pilots who understood that our interest was centered in the collection of such data as would enable us to better understand this bete noir of the air. From all accounts, no airway has more bad weather than the New York (Hadley Airport)-Cleveland line, and of all its bad weather ice is the most dangerous. The finest fliers of this and foreign countries have been bowed down by ice and defeated by ice encountered during the past season between New York and the Lake Region. Plans for an intensive study of this phenomenon of ice are now being prepared for the 1928-1929 season.

METEOROLOGICAL FACTORS affecting airplane flying fall into two main classifications, those which prevent or stop flying and those which affect flying or navigating while flying. The main factor which prevents flight is undoubtedly the accumulation of ice upon the various exposed surfaces of the plane. Its quick action and the small chance of the plane being rid of the trouble by mechanical means gives to this factor grave importance, and the limited character of the experiences of those pilots which have found themselves caught by icing-up weather has resulted in a rather imperfect apprehension of just what goes on during the action known as icing-up, or the accumulating of ice-coats on the plane's surfaces. These ice barnacles threaten a forced landing in so certain terms that any but the best trained pilots should be cautioned against flights through clouds or rain at moderate altitudes above ground where the temperature is between 15 and 40 deg. F.

The pilots who man the planes of the transport line between New York and Cleveland meet as much ice as any in this country; their experiences are varied but from their reports and the theoretical considerations which best fit the facts gathered from them several general truths emerge. This airway has such conditions as a result of at least three factors; the moderate altitude of the mountainous region, the proximity of the Lake Region to the northwest, and the situation on eastern side of a great continent which is a "cold" reservoir in the winter months.

What then is the action of ice upon the plane? From a variety of opinions it appears that the ice-barnacles affect the efficiency of the plane in three ways, perhaps more. (Fig 1) The parasitic resistance offered by struts, wires, outside fixtures of various sorts and the wings themselves (Fig. 4) is immensely increased and the attachment of clods of ice to propeller blades roughens engine action and may reduce the pull. The lifting power of the wings may be diminished by the change in the shape of airfoil by the head of ice on the leading edge (on upper side usually). The weight of the ship may be increased to an amount in excess of the maximum loading. Much diversity of opinion has been found as to the relative weights of the first two actions; there is almost unanimity that the actual weight of the ice is the minor consideration in most flights because the extra load might easily be carried if other factors remained unchanged. All three ways combined have however a powerful influence upon flight and have been said to be sufficient to force a plane to settle after less than ten minutes of exposure to the ice forming conditions.

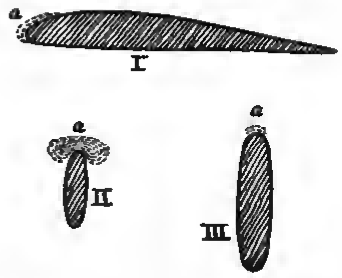


Fig. 1. "I"—cross section of Clark Y type of airfoil. "II"—cross section of streamline wire. "III"—cross section of wing strut. In all three drawings "a" signifies ice accumulation.

These conditions, until recently little studied and less understood, are present whenever water particles impinge upon the plane's surfaces in flight through air at temperatures below the freezing point (32° F or 0° C). These particles may be big enough to be rain-drops falling through sub-freezing air; on the other hand they may be tiny particles of fog or cloud at temperatures as low as 21° below zero F. While they may be existing as water droplets in the free air, upon impinging against the leading edges of the plane's surfaces they change immediately to glaze, (silver thew of the British).

Vertical cross-sections of the atmosphere during the fall of freezing rain are generally on the following order. Near the

Continued on page 1030

The Short "Calcutta"

New English 15 Passenger All Metal Flying Boat is Powered with Three 485 Hp. Geared Jupiter IX Engines

THE "CALCUTTA", a 15 passenger, all-metal flying boat, was recently completed by Short Bros., Ltd., of Rochester, Kent, England. This tractor biplane, understood to be the first of two planes of this type for service with the Imperial Airways, Ltd., is powered with three 485 hp geared Jupiter IX engines. The Calcutta weighs 20,000 lbs. loaded and is said to be able to take off and climb on two engines. It carries a crew of three and a payload of 3,540 lb. or 15 passengers, allowing 236 lb. for each passenger and luggage. Assuming each passenger to weigh 160 lb., this would permit 1140 lb. of express, mail or baggage. The pay load is in addition to the weight of the crew, the crew's baggage, food, water, radio and navigation equipment, and sufficient fuel and oil for a range of 500 mi. With a reduced pay load, and full fuel and oil tanks, the Calcutta has a range of 740 mi. The top speed is 120 m.p.h. and the landing speed 57.5 m.p.h. It has a climb of 800 f.p.m. and a service ceiling of 10,000 ft.

The Calcutta afloat off the Short Bros. Works at Rochester, England. Note the servo-rudder

Short Bros. has specialized in large, all-metal flying boats and presents in this craft a larger plane than it ever built before. The Calcutta is the largest commercial flying boat ever built in England. In design, it follows principles first evolved by that company in 1919. Structurally the Calcutta is similar to the Short Singapore, a twin engine service type for the Royal Air Force. It is a two-bay biplane with three engines mounted between the wings. The wings are above the hull which houses the passengers, crew and equipment. The hull is of monocoque construction with the skin covering taking most of the load, while the wings are metal covered with doped fabric. Except for a few fittings and struts of

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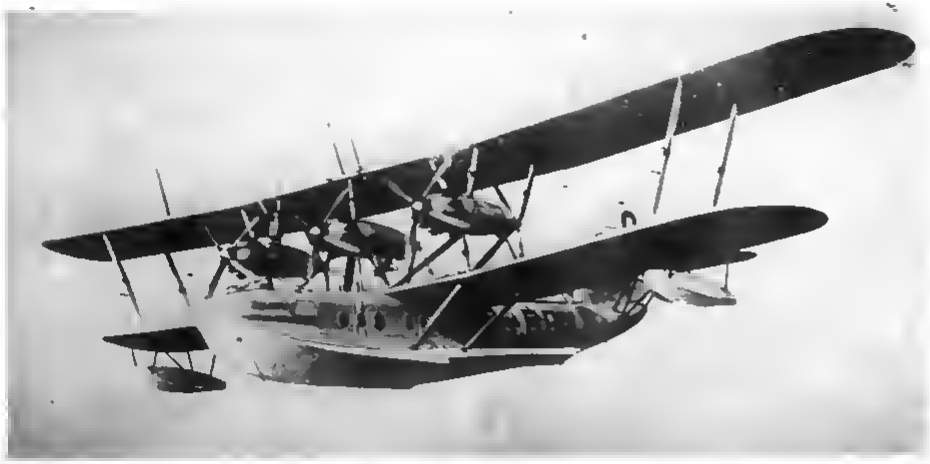


The three engined (485 Geared Jupiter IX) Short Calcutta in flight

Sell *the* Foreign Markets

Problems Involved can be Met Easier Now than if America Waits Until Other Nations Introduce their Products

By BROWER V. YORK

Department of Commerce

AIRPLANE AND airplane engine builders are loaded with orders, we hear. Production schedules are being raised, new factories are under construction and the demand for aircraft and parts is growing rapidly. An increasing proportion of the production is sold in the United States and little attention is given to foreign markets. American and European manufacturers, the latter strongly aided by their governments, went to great expense to create markets for their products after the war. With the extension of regular service, the increase of military air forces and the widespread interest in air transportation following the great successes in 1927, conditions have changed. The demand exceeds the supply in foreign countries as well as at home. Almost unlimited opportunity is open to the American manufacturers of aeronautic equipment of superior quality who will seek foreign sales properly.

The problems involved in securing foreign markets can be met easier now than if manufacturers wait while those in Europe introduce their types and train operators to use them. It would be necessary, after such a delay, to go through the painstaking and slow process of learning the types used and needed abroad, and overcoming the familiarity and attachment of foreign users to European planes. To introduce American types and demonstrate their superiority now would be to increase the sale of our planes, engines, parts, and supplies more rapidly and establish a foundation for such exportation as the automotive industry has accomplished. More than 11 per cent. of the American production of motor vehicles in 1927 were exported.

Increase of 85 per cent. in 1927

In contrast to this large and increasing movement of automotive products to foreign markets, exports of aeronautic products in 1926 amounted to 4.9 per cent. of that year's production. This compares favorably with the 4.1 per cent. of production exported in 1923. Exports in 1927 increased 85 per cent. over those in 1926 and amounted to $1,903,560. The proportion of exports to production must have decreased, for it is almost certain that the 1927 products were worth more than twice as much as those of 1926. Aircraft to the number of 1186 were produced in the United States in 1926. Their value was $8,871,027 and 50, or 3.4 per cent of them (by value) were exported. In 1927, 63 aircraft valued at $543,568 were sold abroad. The production figures are not nearly completed although 2,011 machines of commercial types and 374 military aircraft have been counted. Nearly 6 per cent (by value) of the engines and parts produced in 1926 were shipped abroad and the value of this movement was $724,061. It increased in value to $1,054,992 in 1927.

French exports of airplanes alone in 1927 have been reported to the value of $8,000,000. Thus French exports of aeronautic products must have been worth five or six times as much as ours. Other European countries are increasing their foreign sales and great efforts are being made to exploit other markets and get a strong footing wherever possible at the earliest opportunity.

There are more details in building up export sales and in consummating each transaction than in domestic sales. Important differences in the case of aeronautic products are the time needed, financing and servicing. American purchasers sometimes go to the manufacturer for their needs and accept delivery at the factory. This is the more convenient method for the seller but the sale is for the seller to find his customer and supply his needs. In the long run, airplane builders will comply with the rule.

Aircraft Classed as War Material

Aircraft are classed as war material and by international agreement they are not to be sold in China, for instance. Our embargo on commercial planes to Mexico was lifted only recently. The International Convention on Aviation made at Paris in 1919 contains some requirements to be met by manufacturers providing planes to be flown in member countries. We have not ratified the convention and an inspection by our Government is not according to the convention. Hence in some countries a second government inspection is needed before the owner will be allowed to operate a plane from the United States. Even then in some cases our planes do not meet requirements. It was interesting to note that the "Spirit of St. Louis" with her welded frame did not meet French specifications.

In manufacturing countries there is a strong desire to develop an aeronautic production industry and it is difficult to sell there. Air services are generally subsidized heavily and the assisting government usually specifies that domestic equipment be used here as well as in the military services.

In non-manufacturing countries there are fewer aircraft in use and the needs have not been well developed. Aircraft selling missions from Europe have visited most of them, demonstrated their planes and induced governments to buy a few for the military services. Most of them are training types. Factory representatives (most of whom saw war service) have gone to these countries and trained native pilots and of course stressed the qualities of their equipment.

The longer we delay, the more pronounced and widespread will these difficulties become. American aircraft, engines, parts, supplies and appliances, instruments and parachutes can be sold in the manufacturing countries of Europe where they are highly regarded. Sales of these products there are increasing. Airplane builders can build to specifications and by giving quality and value superior to that offered by European manufacturers, build up a trade among private owners such as clubs, business men, and sportsmen in Europe.

Where European planes have been introduced in the mili-

Continued on page 1020

Special Cabin Mailplane Completed By Travel Air Manufacturing Co.

A SPECIAL cabin mailplane monoplane was recently completed by the Travel Air Manufacturing Co., Wichita, Kan. It is a conventional biplane with a closed cabin between the wings and an open pilot's cockpit in the rear. Powered with a Wright Whirlwind engine the plane is stated to have a high speed of 115 m.p.h. and a landing speed of 46 m.p.h. carrying a payload of 1000 lb. plus night flying

Front quarter view of the special cabin mail plane made by the Travel Air Mfg. Co

equipment weighing approximately 225 lb. The fuselage is well streamlined with a wide passengers' compartment, of 66 cu. ft. capacity, covered with a hinged roof and windows at the sides. The pilot's cockpit in the rear is very roomy, and nowled to protect the pilot as much as possible without impairing his vision. The wings are of single bay design with the upper wing slightly larger than the lower one. They are wired and fitted with both navigation and landing lights; the navigation lights are at the tips of the upper wing while the landing lights are mounted below the wing at the outboard strut points. In the center section of the upper wing are the gasoline tanks with a total capacity of 60 gal. The tanks feed by gravity to the Whirlwind engine fitted with a Hamilton metal propeller. The exhaust manifold is carried below the fuselage and fitted with a heater for the cabin and cockpit. The landing gear is of wide tread with the wheels mounted on struts trussed from the side of the fuselage Bendix brakes were installed.

This plane is understood not to be a standard stock model but a design to be built only on special order. The span is 42 ft.; length, 27 ft. 5 in.; height, 10 ft.; and wing area 383 sq. ft. It weighs empty, with eight flying equipment, 2140 lb., and loaded 3600 lb.

Dept. of Commerce Questionnaire Asks Data for Operations Report

ALL AIRWAY and air service operators, manufacturers, and private owners of planes have been sent the semi-annual operations questionnaire calling for data to be published in the Department of Commerce Aeronautics Branch report, according to William P. MacCracken, Jr., assistant secretary of commerce for aeronautics. The information asked includes: miles flown in each kind of flying, passengers flown, passenger miles, air transport efficiency, express flown, investment, airplanes in operation, and other items of value.

Recipients of these blanks are asked to fill them in and return them as soon as possible. If so requested, the answers of any operator, it is stated, will be kept confidential and used only in compiling general statistics.

"Participation in aeronautics, investments, governmental appropriations, increased traffic—all are directly influenced by the statistics of the industry," states Assistant Secretary MacCracken. "Statistics such as these speak for civil air transportation and are the silent salesmen of flight."

Aeronautical Industry is Entered By the National Marine Lamp Co.

AN AIRCRAFT division has been established by the National Marine Lamp Co. of Forestville, Conn., which for 20 yr. has manufactured marine lamps, marine hardware, fuel tanks, and various other sheet metal, stamped and cast articles, it has been announced. P. G. Zimmerman, who since 1914 has been actively identified with the aircraft industry, first with the Curtiss Aeroplane and Motor Co. at Hammondsport and Buffalo, then with the Eagle Aircraft Co. at Niles, O., and with the Aeromarine Plane & Motor Co., has been retained in a consulting capacity to start the operation of the new department.

It is the intention of the company to first build aircraft parts to the specifications of various manufacturers, and later to develop a line of airport lights. "Our facilities," states H. W. Armstrong, vice president of the company, "will permit us to immediately accept order for gasoline tanks, cowling, and stamped or cast parts. We will shortly," he continued, "be in a position to manufacture ailerons, rudders, stabilizers, and elevators of heat treated aluminum alloy, and be in a position to build pontoons and boat hulls from that alloy."

J. E. Schaefer Now Sales Manager Of Stearman Company at Wichita

ANNOUNCEMENT OF the appointment of J. E. Schaefer as sales manager of the Stearman Aircraft Co., Wichita, Kan., was recently made by Lloyd Stearman, president of the concern. Schaefer, who has had a great deal of experience in sales work, is planning an extensive tour of the country in a Stearman plane in order to put the craft before the public. At present, Schaefer is directing the Stearman exhibit at the All-American Aircraft Show in Detroit.

Following his graduation from West Point in 1917, the new sales manager entered the air service, being trained at the University of Texas and at Kelly Field. Later he was appointed officer in charge of flying and training at Post Field, Fort Sill, Okla.

Following his service work, Schaefer entered the automobile tire and accessory sales field. For the past five years he has been associated with the Chrysler company, contacts with owners, dealers, and distributors in this latter capacity having given him a keen understanding of selling problems.

Arkansas Aircraft Co. Reorganized With More Capital and New Name

FOLLOWING A complete reorganization of the concern, the name of the Arkansas Aircraft Co. at Little Rock has been changed to the "Arkansas Aircraft Corp." New capital has been added to the company, and new officers have been named, the new president being W. F. Moody, formerly the secretary-treasurer.

A new test field was recently completed to be used for trial flights of the "Command-Aire" plane manufactured by the company. Two runways about 1,760 ft. in length and running north-south and east-west have been laid out on the field, which adjoins the factory.

Rufus R. Rand, Minneapolis air transport man, has ordered a Command-Aire powered with the Ryan-Siemens engine and with all exposed metal of the plane nickel plated. The standard Command-Aire is an open cockpit biplane powered with the OX engine.

Lean-to Type Individual Hangar Marketed By Houston Company

NAMED THE "Turtlebak" because of its resemblance to the shell of that animal, a new individual hangar has appeared on the market. It is manufactured by the Notrus Hangar Corp. of Houston, Tex.

The Turtlebak, as may be seen from the accompanying photograph, tapers toward the ground in the rear thus making the hangar resemble the lean-to shelters constructed by woods-

The "Turtlebak" hangar manufactured by the Notrus Hangar Corp.

men. The hangar is made of assembled sections joined together by carriage bolts. Anchor bolts imbedded in the concrete base and flooring fix the structure solidly to the foundation.

The construction of Turtlebak hangars employs the herring bone system of bracing, which, it is said, utilizes to the fullest extent the strength of the materials used, the interlocking being called upon to transmit bending, combined bending, and compression strains rather than tensile and shear strains. The company claims this method of construction to be safer and cheaper than that calling for beams and trusses.

Turtlebak and other shaped hangars of the company are manufactured in sections. It is said that the hangars may be assembled on the desired location within 48 hr. Standard slate, sheet metal, tin, or other types of roofing may be used, and various types of doors are available depending on the locality and weather conditions prevailing in each territory.

The Notrus Hangar Corp. was formed but recently. The officers of the company are Harry E. Weaver, president; W. H. Rankin, secretary and treasurer; Theodore Ahlborn, vice president; Otis S. Van de Mark, chairman of the board of directors, and Daniel Loeb, director of sales and advertising. The offices are at No. 713 Esperson Bldg., Houston, Tex.

Government Gives Russell Mfg. Co. Large Shock Absorber Cord Order

RECEIPT OF an order from the War Department Air Corps Materiel Division for 30,000 ft. of ⅝ in. shock absorber cord has been announced by the Russell Mfg. Co. of Middletown, Conn., through R. C. Fagan, manager of the Aero Department of that firm. A 60 day delivery is to be made.

Private orders for cord have also been placed with the Middletown concern by many commercial manufacturing and operating companies in order to take advantage of the quantity production entailed in filling the large Government contract.

The Russell Mfg. Co. also reports, through F. Acker Thompson, district manager of the New York sales office, receipt of several large orders for Russo Aero Rings from prominent manufacturers of commercial and military planes.

Embry-Riddle Co. at Cincinnati, O., Is Reorganized as Business Grows

GROWTH OF the business of the Embry-Riddle Co. at Lunken Airport in Cincinnati has resulted in a reorganization of the company. John Paul Riddle remains as general manager of the company, but has relinquished many of the detail operations to others. Stanley C. Huffman, chief pilot of the Embry-Riddle air mail line to Chicago, is in charge of all flying as operations officer. The instruction work in the school is also under his supervision.

Charles E. Planck, until recently advertising and publicity man, is now sales manager and is advancing the company's franchises for Waco and Fairchild planes throughout Southern Ohio, Eastern Kentucky, and Southwestern Indiana. C. O. McGuire, a graduate of the school in 1927, is now office manager, while Samuel Wilds is Flying School secretary, and C. B. Matson, bookkeeper.

Okey Bevins serves as assistant operations officer and air mail pilot. Warren Vine is instructing and flying the mail. Don Griffith is in charge of the hangars, and Charles Veigel and Charles Wehrung are flying instructors.

Ralph R. Graichen, chief designer of the Halpin Development Co., heads the technical department in the ground school, and he and Walter C. Clayton, assistant designer at Halpin's, conduct the classes in aerodynamics. Riddle and Huffman teach meteorology, aerial navigation, motors, rigging, and air commerce regulations.

Find Dolphin Pastes and Cements Suitable in Aircraft Manufacture

DOLPHIN PRODUCTS, which are manufactured by The Dolphin Paint and Varnish Co. of Toledo, O., have been found to have many uses in the aeronautical industry. Paints, varnishes, enamels, special pastes, water and gas resisting cements, water and rust-proof cements, etc., are among the products of this company that have been marketed for many years to automobile body builders, boat builders, railroads, and the manufacturers of various items.

A water and gas resisting cement manufactured by the Dolphin company is being used in riveted gasoline and water tanks. It is reported that this compound has stood up well under severe tests and gives satisfactory service. Another Dolphin product that is being used is a special semi-drying paste that is being used in seaplane float and flying boat hull construction. It can be applied in ribbon form with a hand pressure gun and eliminates the use of marine glue and tape. This compound is used between the top of ribs and the duralumin plates that are either screwed or bolted on to them.

In the construction of airplanes and seaplanes, especially those with closed cabins, many uses are made of Dolphinite water and rust-proof cement. This is a product that is widely used in the construction of automobile bodies. It can be used to fasten cloth, leather, imitation leather, etc., to steel, wood, or duralumin surfaces.

Navy Orders 74 Pursuit Airplanes From Boeing Company at Seattle

A CONTRACT for more than $1,000,000 worth of airplanes has been awarded the Boeing Airplane Co. by the Navy Department, according to recent reports, and work on the order has now begun. The contract calls for 74 pursuit planes, most of which are to be assigned to the San Diego base.

Chamberlin Heads Flying Advisory Board Announced by W. E. Arthur

A FLYING Advisory Board consisting of nine leading American pilots, headed by Clarence D. Chamberlin, New York to Germany flier, has been announced by William E Arthur, president of the airport construction company of New York City which bears his name The advisory board will be consulted on matters pertaining to selections of airport sites, their development, etc. The board members other than Chamberlin are Art Goebel, Floyd Bennett, Bernt Balchen, Bert Acosta, R. W. Depew, Jr., C. S. "Casey" Jones, M. M. Merrill, and H. C. Ferguson.

Advice of the board will be especially sought in the development of the Maine to Florida chain of airports planned by the National Airways Terminals, Inc., of New York, which is headed by William E Arthur

Aircraft Engineering Co. of Los Angeles Constructing First Plane

AFTER MONTHS of preliminary engineering the Aircraft Engineering Co, Los Angeles, Calif., is under construction on its first test plane Jigs and dies are all completed and tools are being assembled with a view to immediate quantity production following successful flight tests of this plane. Although the plane now being built is at the Warren School of Aeronautics, a factory building is to be erected beside the warren school that will be equipped, it is said, to turn this model out at the rate of one a day

The plane is of three place biplane design Both wings have no external flying wires, the upper wing being braced to the fuselage by a double tripod structure at the center and the lower wing being braced to the upper by light N struts near the ends of each wing The plane is designed to weigh 1450 lb. light and will have an 800 lb. useful load powered with the 1928 10 cylinder Anzani engine

Jaeger Watch Co. Manufacturing Chronographs for Aircraft Use

THE JAEGER Watch Co of New York City and Geneva, Switzerland, is manufacturing a chronograph that has found many applications in aircraft performance testing as well as use as a regular service clock The instrument has a round dial with the outside scale calibrated in fifths of a second. A single, thin hand points to the numbers on this scale. In addition there is an opening or window on the dial that shows the number of minutes that the clock has been running up to 30 min. when it repeats In addition there is an inside scale showing the time of day Jaeger chronographs are supplied with black dials and white or silver hands or numbers. Luminous hands and numbers may be obtained

L. & H. Aircraft Co. of Hartford Orders 40 More Challenger Planes

THAT 40 MORE Challenger planes have been ordered by the L. & H. Aircraft Co of Hartford, Conn., is announced by the Kreider-Reisner Aircraft Co, Inc., of Hagerstown, Md., manufacturer of the plane. The L. & H company has already had delivery on seven airplanes called for in previous orders, states President A. H. Kreider. The L. & H Aircraft Co is Challenger distributor in New England.

First Three Wasp Engined Fokker 12 Passenger Monoplane Completed

THE ATLANTIC Aircraft Corp., Hasbrouck Heights, N. J., recently completed the first of four Fokker F-10, three 425 hp Wasp engined monoplanes for the Western Air Express. The plane follows Fokker practice, being a high wing monoplane with one engine mounted on the nose of the fuselage and one below each wing. The wings are internally braced and of wood construction, using box spars, plywood ribs and

Front quarter view of the three engined (Wasp) Fokker F-10 monoplane

plywood covering. The fuselage is of welded steel tubing covered with fabric It houses a cabin 16 ft. long, 5 ft. wide, and 5 ft. 9 in. high, fitted with 12 heavily upholstered seats. Behind the cabin are three compartments for mail or baggage. The total cargo space is 140 cu. ft. In addition there is a lavatory fitted with wash basin, running water, etc. In front of the cabin is a roomy pilot's cockpit fitted with dual side by side control. Below the pilots' seats is a compartment for radio or additional baggage.

Though the plane is guaranteed to do 145 m.p.h. on all three engines it is stated that it made 148 m.p.h with full load during its trial flights With two engines it is stated to have a high speed of 122 m.p.h. and a cruising speed of 104 m.p.h It climbs 1420 f.p.m. on three engines and 640 f.p.m. on two engines. The F-10 weighs 6550 lb empty and has a disposable load of 4950 lb. which includes a payload of 2640 lb. giving a total weight of 11,500 lb Additional specifications will be found in the table of specifications printed elsewhere in this issue A detailed description of the plane will appear in an early issue of AVIATION.

Three Engined Junkers with 103 Ft. Wing Span Lands at Croyden

A THREE engined Junkers monoplane recently arrived at Croyden Airdrome, England, where it excited much interest and comment This plane, a G-31 powered with three

The three engined Junkers G-31 monoplane

Gnome et Rhone 450 hp engines, has a span of 103 ft and a length of 55 ft. It weighs 17,000 lb loaded and has a high speed of 125 m.p.h. Accommodations are provided in the cabin for 15 people. In addition to the normal seats, folding berths are provided for night flying Like all Junkers monoplanes it is of low wing design and of all metal construction being built almost entirely of duralumin

Post Office Department Issues Rulings on Air Mail Sent Abroad

SPECIAL STATEMENTS issued by the U. S. Post Office Department rule that air mail posted in this country but addressed to points in Europe must carry U. S stamps to cover the air mail routes of this country, while air mail posted here, addressed to Europe, and destined to pass over a European air mail route must have the entire postage represented in U. S. stamps.

The only case in which foreign stamps are used for articles mailed in this country to be carried by air abroad is on matter addressed to Columbia, S. A., to be carried by air mail after reaching Barranquilla.

A number of foreign countries have availed themselves of the air mail service now in operation in the United States, viz Austria, Belgium, Canada, China, Cuba, Czechoslovakia, Hongkong, Irish Free State, Italy, Japan, Mexico, Netherlands, Norway, Sweden, Switzerland, and the Society Islands. In these countries, the fee for air mail service upon arrival in the United States may be put on in foreign postage. Canada and Cuba require the postage on letters to be carried by air in the United States to be prepaid in United States stamps. Mexico allows United States air mail fee to be prepaid in either domestic or United States postage. All other countries require the air mail fee to be prepaid by stamps issued in the country concerned. Persons using international air mail services should inquire at post offices for rates.

Extend American Railway Express Air Service Over Three Airways

AIR EXPRESS service of the American Railway Express Co. will now be extended to three other airways, that company recently announced. The three lines to cooperate with the express company are the Northwest Airways operating between Chicago and the Twin Cities, the Embry-Riddle line between Chicago and Cincinnati, and the Chicago-St. Louis route.

Under the new schedules, shipments sent from New York City at 7 P.M. will reach St. Paul and Minneapolis at 11:30 and 11:40 A.M., respectively, next day. Shipments consigned to Indianapolis and Cincinnati will be carried to Chicago over the National Air Transport line and will then be sent from that city by air for forenoon delivery in the southerly Indiana and Ohio cities.

Rate per pound for shipments from New York to Indianapolis and Cincinnati will be $1.60 and to the Twin Cities $2. A one pound charge will be the minimum.

Incorporation in Delaware Begun By Ryan Mechanics Monoplane Co.

HAVING PLANNED expansion, the Ryan Mechanics Monoplane Co., builder of the "Lone Eagle," has begun incorporation under the laws of Delaware with a capital of $200,000. The name of the new corporation, which is being backed by prominent Los Angeles business men, is the Federal Aircraft Corp.

Immediate construction is to begin, according to plans, on six new all steel-tube planes of the "Lone Eagle" type. The Officers of the company remain the same as that of the Ryan Mechanics Monoplane Co. with the exception of the treasurer —O R. McNeel, president; H. W Hunbold, vice president; Fred C. Ayars, secretary; and C. R. L. Crenshaw, treasurer.

Regular Portland-Spokane Service Being Begun by Mamer Company

REGULARLY SCHEDULED passenger service between Portland, Ore., and Spokane, Wash., by way of Columbia Gorge Airway through the Cascade Mountains is being instituted by the Mamer Flying Service of Spokane, N. B. Mamer, pilot and head of the company, has announced. Two round trips a week will be run. A Buhl cabin monoplane piloted by Clarence Paulsen will be used in the service.

Flying time will be about three and one-half hours, while fares will be $30 one way and $50 round trip. Way stops will be made according to demand.

Goldendale, Wash., on the line of the service is ripening plans for the establishment of a suitable airport, the local chamber of commerce and the American Legion being the organizations most active in support of the project. Options on ground for the field and pledges of subscriptions to an airport fund have been obtained. The campaign for the port was started last year following the Spokane Air Derby

Gates Flying Circus, Newark, N. J., To Distribute Challenger Airplanes

DISTRIBUTION RIGHTS for the Challenger airplanes in Northern New Jersey and Southern New York including the metropolitan New York area were recently awarded to the Gates Flying Circus and Aviation Corp. of Newark, N. J., by the Kreider-Reisner Aircraft Co. of Hagerstown, Md., manufacturer. An order of five Challengers was immediately entered, the new planes to be brought to Teterboro Airport, Hasbrouck Heights, N J., which is the operations base of the Gates company.

Joseph Ferraro, Dover, N J., automobile dealer, will receive the first plane, a craft equipped with pontoons. Ferraro will use his Challenger for sightseeing trips at Lake Hopatcong, where he obtaind exclusive passenger carrying rights.

Northrup Company of Minneapolis Named Ryan Airplane Distributor

THE NORTHRUP Airplane Co. of Minneapolis, distributor of the American Eagle planes, has been selected by the B F. Mahoney Aircraft Corp. of San Diego, Calif., as a distributor of the Ryan monoplanes. Delivery of the first Ryan Brougham was recently made, Leon DeLong piloting the monoplane to Minneapolis from the San Diego factory with Mr. and Mrs. C. S. Yarnell, Jr., as passengers. C. S. Yarnell, Jr., is vice president of the company, which is headed by Marvin A. Northrup, while DeLong is chief pilot.

President Northrup is now making an extensive tour of Europe in order to study airport and airline operation abroad. He will bring back films showing commercial activities in England and on the Continent.

Sidney, N. Y., Field is Temporarily Closed Scintilla Company Reports

NOTICE HAS been given by the Scintilla Magneto Co., Inc., of Sidney, N. Y., that the landing field at that city is temporarily unavailable for landings and take offs of airplanes. An increase in the size of the airport and other field improvements are being begun, and it is expected that the field will be in good shape for use by Aug 1.

To Hold Northwest Aircraft Show At St. Paul Airport April 26 to 28

THE FIRST Annual Northwest Aircraft Show is to be held at the St. Paul Municipal Airport April 26-28, according to a recent announcement. The show is under the direction of the Aircraft Association of Minnesota which was recently formed by 11 aeronautical companies in that state. Harold L. Rothschild, secretary of the Roth-Downs Airways, Inc., of St. Paul, Norman Warsinke of the Mohawk Aircraft Corp., and Mark Hurd of the Mid-Plains Sales & Transit Co. are chairmen in charge

Exhibits to be Housed in Hangar

Exhibits will be housed in the main hangar at the St. Paul airport where it will be convenient to view the displays as well as note the flying qualities of the show entries. A 90 by 180 ft. tent has been erected adjoining the hangar to increase display space.

In addition to the exhibits by the local distributors, manufacturers, etc., several displays will be brought from the All-American Show in Detroit. These will include a number of new production planes that have recently entered the field, instruments, engines, and plane accessories, and a few of the well known engines as well as some of those that were just placed in production.

Preceding and during the three days of the show, talks will be given by men prominent in the industry, the leading downtown theatres of both cities will show films of historical and educational value pertaining to aviation, newspapers will cooperate by special feature sections, announcements will be broadcast from local stations and attractively arranged window displays will be shown.

Formation Flight a Feature of the Show

The aircraft exhibition will be officially opened by a formation flight of every available plane in the Northwest led by a tri-engined Ford transport over Minneapolis and St. Paul and returning to the starting point at the St. Paul airport. Included in the features of interest will be the demonstrations of night flying equipment, parachute jumping, sightseeing trips in the air at night over the Twin Cities, flying exhibitions by well known pilots, and exhibitions showing how Orpheus Radios will be delivered via the parachute route from Travel Airs in flight.

Some of the distributors, manufacturers and operators who will exhibit planes are: Eaglerock, Minnesota Aircraft Co. of Minneapolis; Waco, Pioneer Airways of St. Paul; Travel Air and Driggs Dart, Roth-Downs Airways, Inc., of St. Paul; American Eagle and Ryan Brougham, Northrop Airplane Co. of Minneapolis, Fairchild Cabin Monoplane, Mid-Plains Sales & Transit Co. of Minneapolis; Mohawk Pinto low wing monoplane, Mohawk Aircraft Corp. of Minneapolis. The Northwest Airways, Inc., will have one of their Stinson-Detroiter mail planes on display as well as the Laird Commercial C-240, that was used by "Speed" Holman during his winning of the Class A Air Derby from New York to Spokane during the past September and in establishing several continuous looping records. Several other makes will be in evidence, some of whose showing will be dependent on arrangements pending with the exhibitors at the All-American Show.

The Minneapolis Civic and Commerce Association, the St. Paul Association and several other leading organizations in the Twin Cities have approved the show and are cooperating with the committee to assure its success.

Call for New Orleans-Border and St. Louis-Omaha Mail Route Bids

PROPOSALS FOR bids on three alternate air mail routes between New Orleans and the Mexican Border connecting at New Orleans with the Atlanta-New York route have been issued by Postmaster General New, returnable May 11. In another statement, Postmaster General New announced that invitations for bids on an air mail route from St. Louis to Kansas City are being recalled, since new bids are being asked to extend this route to Omaha, Neb.

The New Orleans-Mexican Border line will go direct to Houston, Tex. From Houston it may go to San Antonio, to Laredo, or to Brownsville, via Corpus Christi, depending upon the location of the Mexican Border terminal and other circumstance. Under the proposed schedule, planes from New Orleans carrying New York and Boston mail would arrive at Houston about 3 P.M. and at the Border about dark.

The substituted St. Louis-Kansas City-Omaha route would connect with the transcontinental airway in such a way that St. Louis and Kansas City air mail would be greatly expedited to West Coast and intervening cities.

New Corporation in Meriden, Conn., Represents Three Plane Companies

GENERAL COMMERCIAL aeronautics will be entered by the Meriden Aircraft Corp. of Meriden, Conn., which was recently organized. The company will have the agency in that district for the Fairchild, Swallow, and Challenger planes. One of the latter airplanes has already been purchased by the company for commercial use.

According to plans, the city's landing field in South Meriden will be used as a base of operations for the present, and if a suitable lease can be obtained, permanent headquarters will be established there.

Ernest Berns of Kankakee, Ill., has been appointed chief pilot of the Meriden Aircraft Corp. Berns has been actively engaged in commercial air transportation for the last four years, and it is stated that he holds all licenses issued by the Department of Commerce. Berns will act as instructor in the company's school.

The officers of the corporation are C. J. Danaher, president, Leon Englehart and Andrew Kowalsky, vice presidents, A. D. Elster, treasurer, and Norman O. Haneven, secretary.

Huff Daland Company Will Engage In Photography and Sell Airplanes

ANNOUNCEMENT HAS been made by the Huff Daland Dusters, Inc., of Monroe, La., that it has entered into the field of aerial photography in conjunction with the Fairchild Aerial Service, Inc., whom it will represent in the State of Louisiana. The company has also announced that it will distribute the Travel Air planes in that state as well as use them in teaching aerial agricultural dusting.

Edgar N. Gott, president of the Keystone Aircraft Corp., is also president of Huff Daland Dusters, Inc., while L. W. Townsend is treasurer for both concerns. Harold R. Harris is vice president in charge of operations; C. E. Woolman, vice president in charge of sales, and Irwin E. Auerbach is secretary and controller.

Extensive Excavating Work Done On the Oakland Municipal Airport

EXTENSIVE EXCAVATING operations have been carried out at the Oakland, Calif, Municipal Airport in which draglines, trucks, a P & H ditching machine, a caterpillar tractor, and a specially designed grader and scarifier are being used. Lying north of the main runway is a deep ditch, which is being tiled to serve as the drain for the field Cross

Showing the caterpillar tractor and special grader being used in excavating the Oakland Municipal Airport.

ditches at intervals running north and south from the main ditch intersect the field, providing rapid drainage of the entire field during wet weather.

A new caterpillar tractor and a specially designed grader and scarifier built to the specifications of the airport engineers have recently been purchased by the Municipal Airport for various uses in the construction project. The caterpillar is used in dragging the three-quarter ton sections of concrete drain pipe to the various points along the main drainage ditch and in operating a scraper in backfilling the ditch after the pipe has been laid. The machine was built by the Spears Wells Machinery Co. of Oakland.

Dept. of Commerce Has Approved Boeing Model 40B and Lincoln-Page

TWO MORE airplane types have been approved according to a recent Department of Commerce bulletin They are 27. The Boeing Airplane Co.'s Model 40B land plane powered with Pratt & Whitney 525 hp engine, and 28 The Lincoln Aircraft Co. Lincoln-Page biplane powered with the Curtiss OX-5 engine.

The first 21 types approved were listed in the Feb 13 issue of AVIATION, while numbers 22-26 were listed in the March 19 issue.

Sponge-Like Rubber Now Made In Chicago is Useful in Aircraft

THE C/M Co. of America, Chicago, Ill, is manufacturing a light, shock absorbing rubber product which has found many applications in aircraft. C/M Rubber foam (caoutchouc-mousse) appears to resemble sponge rubber being made up of an infinite number of small chambers of very small volume. It has one quarter the weight of sponge rubber and is softer and more pliant. It is waterproof and will float. Many aircraft manufacturers abroad are using it and it appears to be gaining in usage in the United States. It is used chiefly for padding against vibration and noise, as well as forming an excellent material for seat cushions. Other uses include padding of cockpits against shock and lining the walls to provide an insulating material to keep out extreme temperatures. The substance floats as well as acting as an insulator finding use in the lining of flying clothing. According to the manufacturer, a flying suit of this material has sufficient buoyancy to keep two men afloat.

Bernard Air Lines Formed in Ohio For Sales, Service, and Teaching

HEADED BY J H Bernard of the lumber company of that name, the Bernard Air Lines has been formed in Youngstown, O William D Smith, pilot at Watson Field, will have charge of field service, student work, and passenger flights for the company Bernard Air Lines will act as distributor of one of the light commercial planes now on the market. Instruction, regular passenger flights, and sight-seeing tours will be offered by the company.

A flying field has been purchased three miles east of the business section of Youngstown on the Youngstown New Castle Road, and the contract for a hanger, upon which work has already begun, has been given to the Truscon Steel Co. Hangar space, gas, oil, repairs, telephone service, and overnight accommodations will shortly be offered here. The location of the buildings and design of the runway are credited to Lieut. C J Schuemacher, F A I airport architect now with the Owsley Co. of Youngstown.

Air Mail Poundage on Pacific Air Transport Route Shows Increase

AIR MAIL on the Pacific Air Transport coastwise route for the first 22 flying days of February totalled 6362 lb, as compared with 5788 lb for the corresponding period in January—an increase of 574 lb This year's February mail thus far shows an increase of 2227 lb over the corresponding period of February, 1927.

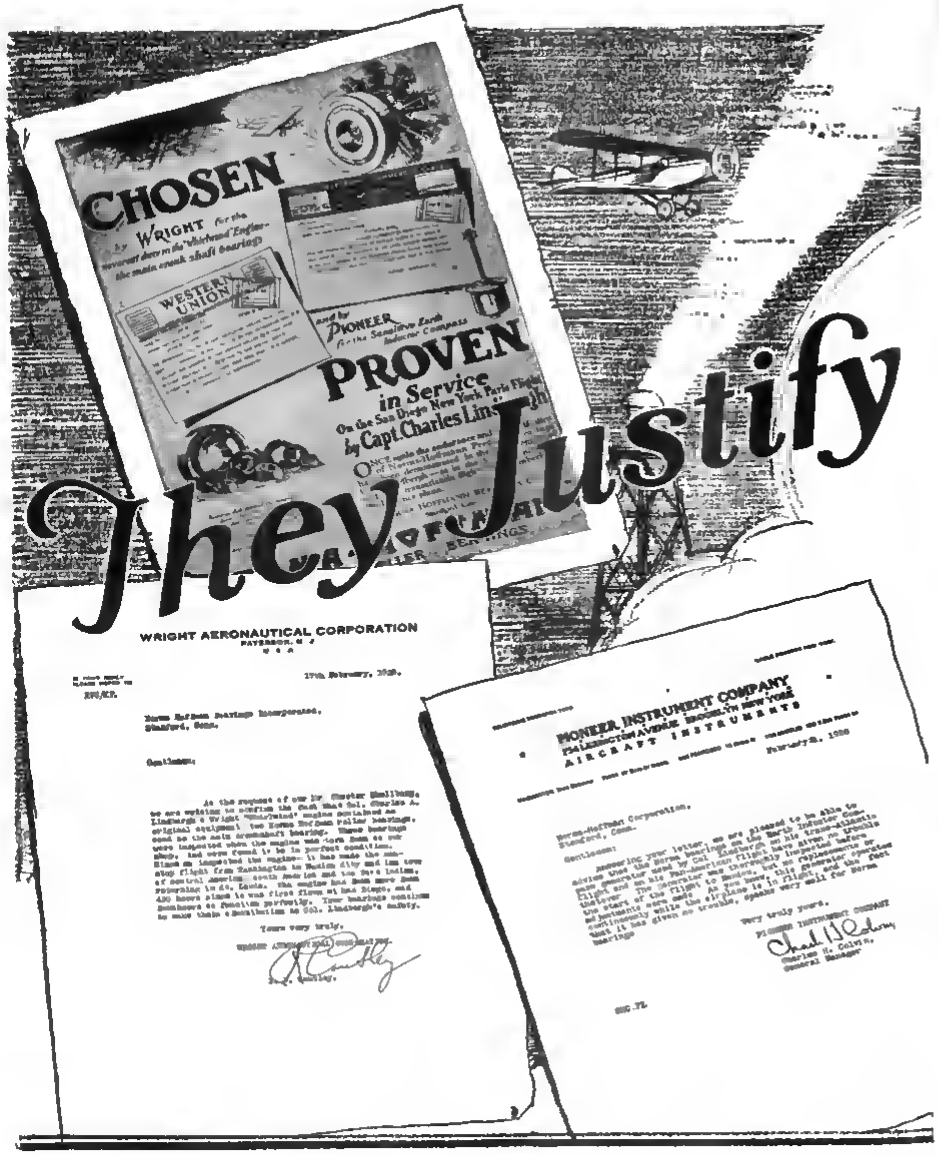
Four new Boeing four passenger cabin planes are now in completion at the Boeing Airplane Co's factory in Seattle and will be ready for the coast service between Seattle and Los Angeles about April 1, according to an announcement by A K Humphries, vice president and general manager of the line These planes are being built to the same specifications as those followed in the construction of the Boeing transcontinental planes, except that the passenger cabin will seat four, and some detail improvements have been added.

Plan Complete New York-Atlanta Airway Weather Report Service

A COMPLETE weather reporting and communications system similar to those now in operation on several civil airways in the United States is planned for the New York-Atlanta airway to be opened this month, the Aeronautics Branch of the Department of Commerce recently announced.

An inspection trip over the entire route was recently made by Thomas H Chapman of the Airways Division and W. R. Gregg, chief of the Aerological Section of the Weather Bureau. They recommended a new upper air station at Greensboro, N. C, for weather observations for the use of pilots flying over the Atlanta route.

The Weather Bureau now maintains complete aerological stations at Hadley Airport, Cleveland Airport, and Cicero Field at Chicago. A new aerological station has also been established recently at the Salt Lake City Airport.



THE factor of safety in aviation motor performance, now developed to a point which astounds non-fliers, must not lull us into a sense of false security. For air safety there is no such thing as a bearing that is too good

Lindbergh and the Spirit of St. Louis have demonstrated the supreme reliability of both Hoffmann and Norma Bearings — they are part of the safety factor which justify him in proclaiming the absence of personal danger. Who wants any flier to be less well guarded?

NORMA-HOFFMANN BEARINGS CORPORATION

Stamford, Connecticut

- NORMA - HOFFMANN PRECISION BEARINGS

N-55

Report for 1927 of Gates Flying Circus Shows 48,695 Flew Safely

A RECORD of transporting 48,695 persons by airplanes which flew 377,716 mi. without injury to pilots or passengers, was established in 1927 by The Gates Flying Circus & Aviation Corp. of New Jersey, according to its annual report to the United States Department of Commerce, Division of Aeronautics, it was recently announced. Offices of the company are at 870 Broad St., Newark, and 140 Main St., Lodi, N. J.

A total of 1,078,932 passenger miles also was recorded. This figure was obtained by multiplying the mileage of each airplane by the number of passengers carried. Aviators and flying enthusiasts who contend that aerial transportation is as safe if not safer than other forms, described the figures as proof of the statement. They pointed out that this record is equal to flying one passenger from New York to San Francisco some 430 times without injury.

The flying covered in the 1927 report included passenger and school operations at Teterboro Airport, Hasbrouck Heights, N. J., as well as the flying circus touring the nation under the direction of the American Society for Promotion of Aviation.

The report recorded 304 hr. teaching students, 5,246 hr. passenger flying, one hour of aerial photography, 218 hr. of exhibition work, and 816 hr. of cross-country travel.

One death was reported, that of a professional "dare-devil" engaged in "stant" work. He was an acrobat, not a pilot. Accident losses for the entire year totalled $5,500. Flying equipment used included eight four-passenger planes, on two-passenger plane, and a single passenger plane—a tiny Bellanca formerly flown by Clarence Chamberlin.

Ski Landing Gear on Byrd Plane Tested in Heavy Canadian Snow

IN ORDER to test the use of a ski landing gear under heavy snow conditions on the Bellanca monoplane to be used in the Byrd Antarctic Expedition, Floyd Bennett and Bernt Balchen recently flew the South Pole monoplane to the Fairchild Lac a la Tortue Airport of Fairchild Aviation, Ltd., Grand'mere, Province of Quebec, Canada. Here a dozen flights were made off the lake on the ski gear, the arrangement proving successful.

The monoplane was flown back to St. Albans, Vt., the same day where a wheel gear was substituted for the skis prior to the return trip to New York. Mr. Mulrov of the Antarctic Polar Flight, Mr. Weatherby of the Wright Aeronautical Corp., and a New York Times reporter accompanied Bennett and Balchen on the flight to Canada.

Advance Aircraft Co. Begins Use Of Ryan-Siemens as OX Days Fade

COINCIDENT WITH the announcement of an increase of $500 in the price of the Waco 10 equipped with the Curtiss OX-5 engine, officials of the Advance Aircraft Co., Troy, O., stated the end of the OX engine is in sight. A stock of 300 of these power plants was fortunately picked up recently, it was reported, but these will soon be gone.

With the 300 engines promising only a supply for a few months, the company has already started quantity production of the Waco using the Ryan-Siemens engine. Several other American power plants however will be tested in the near future by the Advance company.

National Air Transport Airplanes Cover Total of 5,800 Mi. a Day

NATIONAL AIR Transport planes now fly approximately 5,800 mi. in 24 hr., of which about 3,500 mi. are flown at night. Since May 12, 1926, when operations were begun over the 905 mi. Chicago-Dallas route, its planes have flown a total of nearly 2,000,000 mi. Passengers are carried in the day planes between Chicago and Kansas City on a regular schedule, making intermediate stops at Moline, Ill., for the quadcities of Moline, Rock Island, East Moline, Ill., and Davenport, Ia., and at St. Joseph, Mo. Passengers with bonafide reasons for making such a trip when space is available for them, are carried in the mail planes between New York and Chicago. None of the scores of passengers carried by National Air Transport have ever suffered injury.

The 25 pilots of National Air Transport, it was computed some time ago, had spent an aggregated sum of 88,218 hr. in the air. Considering the average speed of an air transport plane as 100 m.p.h., these pilots' time in the air would be equivalent to 8,821,800 mi.

The Detroit and Tulsa extensions will, when put into operation, increase N.A.T.'s daily flying to slightly above 6,000 mi.

Seven Airway Lighting Projects Are to be Completed by June 30

SEVEN LIGHTING installation projects on airway routes in the United States remain to be completed by June 30, end of the fiscal year for the Department of Commerce, according to the program outlined by Capt. C. F. Hingsburg, chief engineer of the Airways Division, Aeronautics Branch.

These are installation of airways lighting San Francisco to Redding on the San Francisco-Seattle Airway and San Francisco to Blue Canyon on the San Francisco-Salt Lake Airway, completion of the survey of the Louisville-Cleveland Airway and installation of lighting equipment, installation of lighting equipment from Vickery to Detroit on the Cleveland-Detroit Airways, survey of the Blue Canyon to Salt Lake Section of the San Francisco-Salt Lake Airways, survey of the Apex to Salt Lake Section of the Los Angeles-Salt Lake Airways, survey of the Mobile to Atlanta section of the New Orleans-Atlanta Airways, and survey from Tulsa to Fenica City.

Winnesheik Flying Club Recently Formed by La Crosse, Wis., Men

AT A recent meeting, a group of aviation enthusiasts of La Crosse, Wis., organized the Winnesheik Flying Club. Officers were elected, by-laws adopted, and contracts signed by the members.

Membership in the Winnesheik Flying Club consists of three types. class "A" includes those who are interested from a promotional standpoint; class "B", those who are ready to take the ground course and learn to fly at a later date; and class "C", those who are to take a pilot's course immediately.

A new plane of the popular OX-5 engined commercial type will be purchased. Officers are now negotiating for the services of a pilot instructor.

The club has already taken promotional steps by painting markers on various roof tops, in keeping the airport in shape, and by entertaining visiting fliers. Detailed information for prospective members may be had by writing to Winnesheik Flying Club at La Crosse.

See how Goodrich Contributes to Aviation —

at the All-American Air Craft Show

DETROIT

APRIL

14TH TO 21ST

Processes which add to the safety of flying—products which keep pace with the mounting demands of a rapidly growing industry—will make the Goodrich exhibit of genuine interest to all who visit the Show.

Here you will see the largest airplane tire ever built—a Goodrich Silvertown.

Here you will find the new Goodrich safety tread Silvertowns for airplanes.

The Vulcalock process, used exclusively by Goodrich, has opened new possibilities of safety and endurance, by making rubber adhere inseparably to wood or metal. This process will be another interesting feature of the Show.

Visit the Goodrich Booth—and see how rubber is helping aviation.

THE B. F. GOODRICH RUBBER COMPANY, Akron, Ohio
Established 1870 Pacific-Goodrich Rubber Company, Los Angeles, Calif.
In Canada: Canadian Goodrich Company, Kitchener, Ont

Goodrich Rubber *for Airplanes*

Aero Club at Little Rock Teaches Its Members Flying at Low Cost

AN AVIATION club within the reach of the $25 a week salaried young man has been organized in Little Rock, Ark. The initiation fee in this club for the charter members is only $25. Instruction is to be paid for at the rate of $5 per hour, and the plane is to be rented by soloists at the same price.

The club was organized with 40 charter members, each paying the admission fee of $25. For its instructors, it has obtained W. A. Miller, former naval pilot, and Lieut. James C. Youngblood, of the 154th Observation Squadron, Arkansas National Guard. Miller is giving his work to the club in order to open potential markets for the planes of which he is representative. Youngblood, who has other sustaining occupations, is charging practically nothing for his services.

Classes in aerodynamics, and other theoretical instruction are held every night so that it is possible for all members to attend. The club has leased a field for its own private use. This field is 48 acres of level land, with a clear approach in all directions.

It was necessary for the club to buy an old production plane in order to keep the cost from being prohibitive. All members of the club are less than 25 yr. of age. Several of them are enlisted in the 154th Observation Squadron. Advertising in the Little Rock papers was given to the club by one of its members, the owner and manager of a radiator repair shop.

Camden, N. J., Plans a Three Day National Air Meet for May 25-27

CAMDEN'S THREE day National Air Meet to be held late in May will be featured by a cross-country, "On-to-Camden", non-stop flight, according to an announcement by officials of the Camden Chamber of Commerce and the South Jersey Aviation Club, joint sponsors of the meet.

A first prize of $2,000 or $2,500 is being considered for the non-stop flight into Camden, according to Loyal D. Odhner, secretary of the chamber, and Maj. Earl A. Cryne, president of the Aviation Club. There also will be other cash awards and racing events. The Moro-Philips tract on the east side of Cooper River and fronting on State St. will be used for the meet.

The meet will be held May 25-27. Friday, May 25, has been designated as "Boys' Day" with model airplane racing and other such features. Saturday will be "Racing Day", the finish of the "On-to-Camden" flight being scheduled for that time.

"Exhibition Day" will be observed on Sunday May 27. Such phases of commercial aviation as aerial photography, forestry patrol, Army and Navy flying and maneuvers, cotton dusting, air mail services, cross-country transport, new developments in aircraft and cabin planes, seaplanes, new commercial planes, airport lighting installations, and aircraft accessories will be featured.

"Exhibition Day" also will be featured by parachute jumps and other stunts. Although the educational exhibits now under consideration will be featured on the third day of the meet, they will be open for inspection on each of the three days.

The United States Navy dirigible, Los Angeles, is expected to make the flight from Lakehurst on at least one of the three days and arrangements are being made to secure several smaller dirigibles.

Among those receiving special invitations are Col. Charles A. Lindbergh, Ruth Elder, Clarence D. Chamberlin, "Eddie" Rickenbacker, Lieut. Lester J. Maitland, Art Goebel, "Eddie" Stinson, Brock and Schlee, Orville Wright, Glenn Curtiss, Lieut. Comdr. Charles D. Rosenthal, captain of the Los Angeles, Lieut. Comdr. Richard E. Byrd, and also many of the country's World War "aces".

Governor A. Harry Moore will be asked to represent the State of New Jersey. The cooperation of aviation enthusiasts throughout Southern New Jersey will be sought, the support of several communities having been promised by representatives of those communities.

The meet will be held under the sanction of the National Aeronautic Association. The educational exhibit will be stressed and, according to preliminary plans, will be located at the entrance to the Moro-Philips tract. The entire meet will be conducted along educational lines, its chief purpose being to acquaint the average citizen of the amazing strides aviation has been making and to promote aviation in general throughout Southern New Jersey.

A Committee of 50 Members

The meet will be financed under a plan outlined by Mr. Odhner. It provides for contributions by business men and merchants of Camden and Camden County. A committee of 50 members of the South Jersey Aviation Club will be formed under the chairmanship of Mr. Odhner to canvass the community. The committee held its first meeting recently at the chamber of commerce and will make its first report at the next monthly meeting of the club.

Other committees will be named at the meeting, including those for prize donations, program, advertising and publicity, management, rules, and concessions.

Lieut. C. Victor Williams has been appointed chairman of a committee to interview Mayor Price of Camden to ask the city's cooperation in having the Moro-Philips tract placed in shape for the meet. The tract has airplane runways of 1,500 to 1,800 ft., with excellent unobstructed approaches. All that is required is the cutting of weeds and some slight leveling. The field is flat and dry. The financial goal is between $6,400 and $10,000. This is expected to cover all expenses.

California Publishes State Airport Booklet Showing 58 Landing Fields

THE AERONAUTICAL committee of the California Development Association has, through the cooperation of local chambers of commerce, published a most useful booklet entitled "Airplane Landing Fields of California", which describes the landing facilities in that state. Fifty-eight landing fields are listed, one page being devoted to a description of the field and another giving a sketch showing the field's shape in relation to the town. The book is mimeographed and bound in loose leaf form so that additions can be made. Each description printed gives the size of the field, its elevation, the condition of the ground, dangerous obstacles in the neighborhood, and hangar, gas, oil, and telephone facilities as well as prevailing wind conditions.

In looking over the data supplied, it would appear that the majority of the fields are municipally controlled. Many of the landing places listed are not yet developed, being small in size and lacking hangars. More than half the number, however, have runways over 2,000 ft. in length and have one or more hangars.

The aeronautical committee of the California Development Association is to be congratulated on issuing this booklet of such great value to fliers travelling through California. The state has set a good example which might well be followed by aeronautical committees elsewhere.

People keep right on buying

Prest-O-Lite
DISSOLVED ACETYLENE

Because they have confidence in a product that has been manufactured for 23 years. But mainly because it is the most reliable and economical fuel for oxy-acetylene welding and cutting.

THE PREST-O-LITE COMPANY, INC.
Unit of Union Carbide and Carbon Corporation

UCC

General Offices: Carbide and Carbon Building
30 East 42d St., New York
37 Plants—102 Warehouses

Keeping out poor welds

The best welds can be made only with the best welding rod. It is a plain case of metallurgy.

That's why Oxweld welding rod is manufactured to meet rigid specifications. Not only is chemical analysis specified but actual welding tests are made with every lot of rod before it is stamped with the Oxweld trademark.

OXWELD ACETYLENE COMPANY
Unit of Union Carbide and Carbon Corporation

NEW YORK CITY, 30 E. 42d St. UCC STOCKS IN 41 CITIES
CHICAGO, 3642 Jasper Place SAN FRANCISCO, 8th & Brannan Sts.
IN CANADA, Dominion Oxygen Company, Ltd., Toronto

Oxweld

WELDING AND CUTTING APPARATUS

Atkinson Aviation Co., Gary, Ind., Offers Full Aeronautical Courses

FULL FLYING and mechanics courses are being offered by the Atkinson Aviation Co. School of Aeronautics at Gary, Ind., a few miles south of Chicago. L. H. Atkinson is chief instructor and head of the company.

Many students are reported to be taking instruction in airplane mechanics, welding, and construction as well as in

Students of the Atkinson School working in the school shop

flying. The company announces it is doing business in all aeronautical branches. Jay flying, exhibitions, and cross-country trips are offered, while airplanes and engines are bought, sold, exchanged, repaired, or rebuilt according to order.

L. H. Atkinson, a veteran flier, is credited with many hundreds of hours in the air. He has won places in three national races and has been appointed official contest committee representative of the N.A.A. for issuing F.A.I. certificates in his district.

Tabulation Shows California and New York Have Most Airplanes

IN NUMBER of planes, California heads the list with New York second, according to the tabulation of 2,715 airplanes thus far licensed, identified, or given temporary numbers pending inspection out of the total of 4,555 applications received by the Department of Commerce Aeronautics Branch up to March.

The Department of Commerce tabulation follows:

	Licensed	*Identified*	*Temporary Numbers*
NEW YORK	118	72	78
ILLINOIS	94	62	59
CALIFORNIA	68	134	254
MICHIGAN	67	59	40
PENNSYLVANIA	62	29	46
MISSOURI	63	38	21
OHIO	38	49	49
KANSAS	33	25	26
TEXAS	32	111	61
WASHINGTON	32	5	14
OKLAHOMA	27	26	31
DIST. OF COL.	26	6	1
MASSACHUSETTS	21	12	11
MINNESOTA	21	16	7
FLORIDA	16	18	10
VIRGINIA	15	7	10
WISCONSIN	14	24	16
NEW JERSEY	13	7	18
NEBRASKA	13	6	11
IOWA	13	16	10
CONNECTICUT	11	7	6
N. CAROLINA	6	5	6
GEORGIA	6	15	7
LOUISIANA	8	15	8
ARKANSAS	6	6	6
TENNESSEE	7	7	6
MARYLAND	7	16	11
INDIANA	6	14	42
S. CAROLINA	5	0	5
DELAWARE	4	0	0
UTAH	4	1	2
WYOMING	4	2	3
COLORADO	3	5	5
S. DAKOTA	3	4	4
W. VIRGINIA	3	6	6
ALASKA	2	0	8
KENTUCKY	2	2	10
MAINE	2	3	3
MISSISSIPPI	2	1	1
MONTANA	2	7	7
NEW HAMPSHIRE	2	0	0
OREGON	2	2	21
ALABAMA	1	3	4
NEW MEXICO	1	2	1
ARIZONA	0	1	2
N. DAKOTA	0	15	1
IDAHO	0	2	7
NEVADA	0	2	0
RHODE ISLAND	0	4	0
VERMONT	0	0	2
CUBA	0	1	0
HAWAII	0	0	1

New West Coast Company Plans Commercial Air Line to Chicago

PLANS FOR a $2,000,000 commercial air line to span the Pacific Coast, then turn and reach as far east as Chicago and eventually New York have been announced by Charles V. Eakin, president of the West Coast Air Transport Co. of Portland, Ore. Eakin will head the new company—the Union Air Lines—for which articles have already been filed in Salem, Ore. L. G. Devaney, now chief pilot of the West Coast company, and Miss Sadie Lee joined Eakin in the incorporation.

The new concern is designed to absorb the West Coast Air Transport Co., now offering passenger service between Seattle and San Francisco, and schedule regular service along a route which will include Seattle, Portland, San Francisco, Los Angeles, El Paso, Tex., St. Louis, and Chicago. Tri-engined planes will be used, it is announced.

The West Coast company is now using two large Bach monoplanes each of which carries eight passengers and two pilots. President Eakin announces that four more planes of like size and construction and a fifth large enough to carry 22 persons have been ordered.

Four New Chapters of N.A.A. Are Formed in State of Kansas

FOUR NEW chapters of the National Aeronautic Association have been formed in Kansas through the efforts of Roscoe Vaughn and his associates in the Wichita Chapter, according to an announcement from the headquarters of the association in Washington, D. C. The new chapters are located at Junction City, Dodge City, Lyons, and Winfield.

Airplane Factories in Wichita

TRAVEL AIR MANUFACTURING COMPANY
SWALLOW AIRPLANE COMPANY
CESSNA AIRCRAFT COMPANY
STEARMAN AIRPLANE COMPANY
LAIRD AIRCRAFT COMPANY
SWIFT AIRPLANE COMPANY
LARK AIRPLANE COMPANY
QUICK AIR MOTORS COMPANY
BLUE STREAK MOTORS COMPANY

ALSO

Chair of Aeronautics — Wichita University
2 Flying Schools
1 National Air-Mail Line
1 Passenger & Express Air-Transport Line

Pioneers and Leaders of Commercial Aviation

WICHITA'S position as the Pioneer of Commercial aviation is unquestioned and unchallenged.

Her claims to leadership today, however, are not based on her pioneering record, but on

1st. The fact that Wichita will produce this year one fourth of all the commercial planes made in America, and

2nd. The air-mindedness of her business-men, and their unified determination to maintain Wichita's position of leadership. To this end, Wichita has given and will continue to give her best, in unstinted co-operation to her airplane manufacturers, and in her resources, both of men and financial support.

What Wichita Has to Offer

The Kansas Plains are one vast, unending landing field. America offers no more ideal terrain for airplane manufacturing and testing. With an average annual temperature of 56.2 degrees, Wichita offers ideal flying weather 365 days of the year.

Here is also an ample supply of low-priced labor, not affected by strikes or walk outs, with cheap natural gas and electric power in abundance. Near the geographical center of the country, with excellent shipping and terminal facilities, raw materials are quickly and easily obtained from any part of the country.

There is room in Wichita for additional airplane manufacturers, as well as other industries allied with aviation. Wichita wants builders of airplane motors, distributors of airplane parts and supplies, etc.

Write or wire today for further information about Wichita's many advantages.

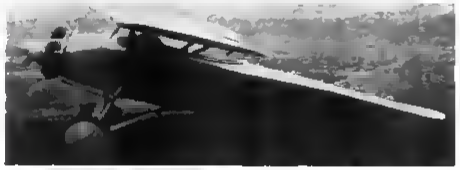
*

CHAMBER OF COMMERCE

WICHITA - KANSAS

Vulcan Aircraft Corp. Completes Monoplane Called American Moth

THE VULCAN Aircraft Corp., Portsmouth, O., recently built an externally braced, open cockpit monoplane that is now completing a tour through the southern United States The "American Moth", as it has been named, is powered with



Side view of the American Moth manufactured by the Vulcan Aircraft Corp, Portsmouth, O

a 60 hp. Air-Cat engine. It is constructed of a welded steel tube fuselage and wood wings. Though the methods of construction are conventional, the design is quite original The fuselage is exceptionally well streamlined with a pointed spinner on the propeller. There is a single cockpit fitted with dual control with the seats in tandem. The wings are built in two panels with the inner edge of each panel cut at an angle to provide for a triangular center section tank The wing tapers in plan and chord and has its thickest section at the point of attachment of the external bracing. The American Moth weighs 600 lb. empty and 1000 lb. loaded. It has a span of 30 ft. and a length of 17 ft. 10 in. It is stated to have a high speed of 110 m.p.h. and a landing speed of 40 m.p.h. It has a climb of 800 f.p.m. and a service ceiling of 18,000 ft. The plane was designed by Harvey Doyle, while the stress analysis was made by Jan Pavlecka. William K. Doyle supervised production

Efficient Instrument Board Layout Used by N.A.T. on Douglas Planes

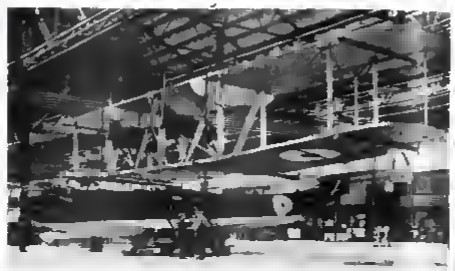
A VERY efficient instrument board layout is now standard equipment on all of the Douglas Mail Planes belonging to the National Air Transport, Inc. The major flying instruments are arranged with a Pioneer turn and bank indicator in the center located so that it works about the true rolling axis of the plane. Above it is mounted a large bank indicator while at the sides and below is an altimeter, an air speed indicator, and tachometer These instruments have their faces set so that in normal flight the hands or indicators on all instruments point toward the center of the turn and bank indicator. Thus when things are functioning properly the pointers on the instruments seem to radiate from one center like the spokes of a wheel. Above the large bank indicator is a compass. The instruments are mounted on a panel insulated against vibration by felt and rubber.

Nicholas-Beazley Completes New Barling Three Place Monoplane

THE BARLING monoplane was recently flown for the first time at the Marshall Flying Field, Marshall, Mo It is a low wing monoplane designed by Walter H Barling for the Nicholas-Beazley Airplane Co. The wings are of full cantilever design and said to be of all metal construction. Welded steel tubing is used for the fuselage construction. Provision is made for three people, two passengers in front and the pilot in the rear. Powered with a 600 hp. Anzani engine the plane is said to have an exceptionally quick take off and low landing speed. It will be recalled that Barling is the designer of the Barling Bomber built for the Army a few years ago.

Unit Assembly Used by Supermarine On Large Twin Engine Flying Boats

AT THE Supermarine Aviation Works, Ltd., Southampton, England, difficulties were encountered in the assembly of the large twin engine "Southampton" flying boats. These were solved by building parts of the planes in units and later assembling the various units. As an example, the wings are built in three panels each, the center section and the outer



Setting the wings on the hull of a Supermarine "Southampton".

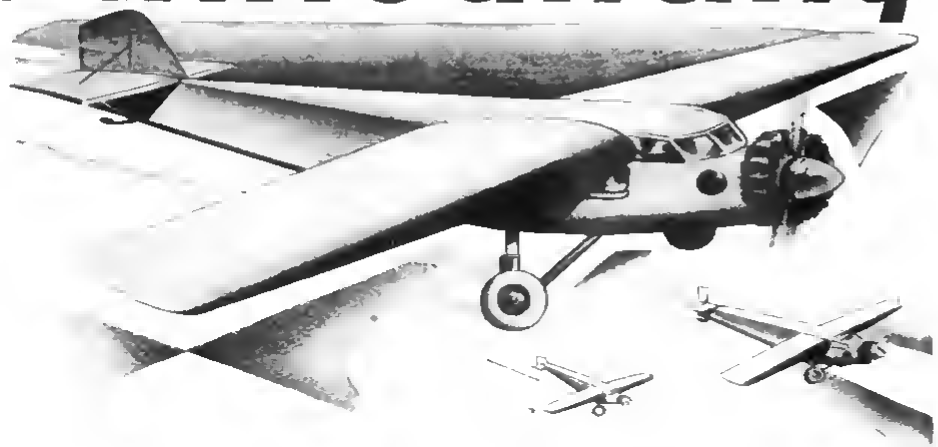
panels. The center unit is assembled with the two Napier Lion, 470 hp. engines mounted between the upper and lower center sections. At the same time the outer panels on each side are assembled and later joined to the center unit. After the rigging is partly completed the entire wing truss is raised and the hull is rolled under it. The wings are then lowered and bolted in place.

The Southampton is a five place military flying boat fitted with two machine guns in the rear and one in the bow It is stated to have a high speed of 107.7 m.p.h. and a landing speed of 56 m.p.h. With a military load of 2030 lb., it has a gross weight of 14,300 lb

Regarding a Caption Printed in The March 19 Issue of Aviation

A CAPTION under a picture on page 706 of our March 19 issue has apparently given rise to considerable confusion. When the Skywriters first came to this country they cast about for some novel way of getting advertisers interested in their skywriting. They therefore wrote in the sky, "Call Vanderbilt 7100", which was their office number. Many advertisers realized the effect on the crowds which saw the performance and telephoned to the Skywriters' office to find out more about it. As a result the Skywriters received a large contract. The idea of writing the office telephone number was originated by H. A. Cameron and Major Jack Savage of the Skywriting Company and not as stated in the caption under the picture.

Announcing



THE New Hamilton Metalplane is now built in four standard models — two for land service and two for sea. In either case they are quickly and easily convertible — adaptable to all flying conditions.

The Silver Streak and the Silver Sea-dan, as called because of their remarkable performance and graceful flight, are equipped with the Pratt & Whitney "Wasp". Ample power is held in reserve to conquer battling headwinds or to "pull out" in a dead calm. The New Hamilton Metalplane is bigger than the weather. This is of special importance to air line operators.

The Silver Eagle and Silver Swan vary only in size and motor capacity. They are equipped with the Wright "Whirlwind" — the same motor with which a Hamilton Metalplane won first in efficiency in both the Detroit News and Aviation Town and Country Club events at Spokane. The winning of these two events demonstrates the economy of this combination.

The New Hamilton Metalplane achieves a new standard of safety. Constructed entirely of Alclad duralumin, it is fire-resisting and weather-proof. Because of its inherent stability, it may be flown "hands off" for long periods of time and if driven to a stalling point, will right itself.

Because of its sturdy construction, the New Hamilton Metalplane withstands the strain of thousands of miles of steady flying. Known strength of materials allows adequate margins of safety without waste. In the recent Ford Reliability Tour, a New Hamilton Metalplane placed second.

In luxury and appointments the New Hamilton Metalplane conforms with the finest enclosed motor car. The spacious cabin, capable of comfortably seating eight passengers, is beautifully furnished in fire-proof Mohair. Interior fittings, dome light, vanity case and cigar lighter are flanked in oxidized silver. An abundance of insulation assures quiet and protection from the cold.

These, then, are but a few of the many features of this truly remarkable plane. Let us give you complete information and specifications so that you may give it the careful study and analysis that is in keeping with its achievement. We will gladly send them upon request.

Our representatives at the Detroit Show will be pleased to discuss dealer openings with reputable, well financed distributors.

Hamilton

.....THE NEW WASP POWERED HAMILTON METALPLANE

AIRCRAFT history is in the making — for the New Hamilton Metalplane, powered by the Pratt & Whitney "Wasp", is not only new in appearance and performance . . . it is new in mechanical design and construction. It is the advanced expression of a wholly new idea in modern, economical air transportation.

We consider the New Hamilton Metalplane a most important contribution to the progress of the aircraft industry. We determined to bring new comfort, speed, safety, economy and reliability into the field of commercial flying, and believe we have succeeded.

The New Hamilton Metalplane is the result of years of careful planning — built for today and tomorrow, after the most practical and satisfactory design that modern engineering can devise. It is constructed entirely of Alclad duralumin and alloy steel, for durability is the very heart of airplane value. It has unusual speed and power for present-day requirements. It is quick and easy to handle. It is steady and sure on the open sky-ways, with the stamina so necessary for mile-after mile and year-after-year service.

Compare the New Hamilton Metalplane, with other planes of similar size and capacity. Compare it for comfort, for maneuverability, for reserve power to meet the unexpected, for low cost of upkeep, and for its sturdy ability to stand up under countless miles of continuous flying.

Then you will understand why this announcement is of importance to aviation. Then you will know why the New Hamilton Metalplane should be your plane.

HAMILTON METALPLANE COMPANY, Milwaukee, Wis.

Four R.A.F. Supermarine Flying Boats Complete 9000 Mile Cruise

FOUR ALL metal flying boats of the British Royal Air Force recently completed a 9,000 mi. cruise from Plymouth, England, to Singapore on the Malay Peninsula. The flight was an effort to carry out an air cruise equivalent to that of warships on the sea and it was completed without incident. It lasted four months with the crews living most of the time on board the planes. The planes are Supermarine "Southamptons".

The Supermarine Southamptons used on this cruise are of all metal construction. They are biplanes with the wings mounted above the hull and two Napier Lion, 470 hp., water cooled engines mounted between the center section panels. The hulls are constructed entirely of duralumin except for the fittings which are of stainless steel. They have concave V bottoms of two step design. In the bow is a cockpit for the forward gunner, who also acts as bomber. Behind, is the pilot's cockpit connected to the navigator's cockpit, slightly to the rear. The navigator also acts as relief pilot. Aft of this is a closed compartment for the navigator. It is fitted with an armchair, table and instrument racks. Radio equipment, including direction finding apparatus, is also provided. In the hull, aft of the trailing edge of the wing, are two rear gun cockpits, each fitted with a mounting for a Lewis machine gun. The planes have a span of 75 ft. and a length of 49 ft. 8 in. The wing area is 1426 sq. ft. and the weight is 6,010 lb. empty. With a useful load of 5,290 lb. the total weight is 14,300 lb. They are stated to have a high speed of 107.7 m.p.h. and landing speed of 56 m.p.h. The normal range is 680 mi. and climb of 610 f.p.m. with a service ceiling of 14,000 ft.

Orange Car and Steel Co. in Texas Enters Hangar Construction Field

ENTRANCE INTO the hangar construction business was recently made by the Orange Car and Steel Co. of Orange, Tex. A $7,000 steel hangar is being built at the Beaumont, Tex., municipal airport by the company to be ready in May, while others are now under construction at Orange and at Shreveport, La. A contract to erect a number of hangars at Winburn Field, San Antonio, has also been made.

J. I. Byrne, manager of the Orange Car and Steel Co., also heads an operating company which has been given a lease on the new Beaumont field structure. Two new production planes and one war surplus plane will be used by the operating company for passenger and instruction work, according to Byrne. A Ryan Brougham has also been ordered for use in Orange and Beaumont.

Passenger service and sightseeing tours during the Democratic National Convention to be held at Houston, Tex., in June is one of the specialties planned.

Lieutenant Flo to Operate School And Aerial Taxi Line Near Detroit

LIEUT. LEONARD S. Flo, pilot for the Wise Birds, a flying club of employees of the Union Trust Co. of Detroit, Mich., has been granted a permit by the Fordson Council to operate a flying school and aerial taxi service near Detroit. The field will be established at the corner of Ford Rd. and Wyoming Ave., Lieutenant Flo said. He further stated that the new school and taxi service will be one of a national chain planned.

Klemm Arrives in this Country To Import Klemm-Daimler Planes

HANS KLEMM, designer of the German, Klemm-Daimler, light monoplanes, recently arrived in this country aboard the S.S. *Dresden*. He was met at the boat by George Kern, Jr., of New York City, who, last summer, toured Europe with William Seypelt in the Klemm-Daimler monoplane, "Yankee Doodle". It is understood that the firm of Kern & Klemm is being organized for the importation of Klemm-Daimler monoplanes into this country and will have offices at 245 W. 41 St., New York City. The company will be entirely independent of the Klemm-Daimler company abroad.

A short time ago Kern returned to the United States from Germany and brought with him three Klemm-Daimler monoplanes, one of which is the Yankee Doodle. At the time of this writing the planes are being assembled at the Barrett Airways field at Armonk, N. Y., just north of New York City. They are low wing monoplanes powered with two cylinder, horizontally opposed, air cooled engines rated at 20 hp. The planes are quite conventional in design except that in addition to the normal ailerons the wing tips are hinged so that their angle of attack may be changed. This area, which is only about a foot wide, is connected to the ailerons; when the angle of one tip is increased the other is decreased.

Heater for Starting Engines in Cold Weather Developed by Army

A WATER heater for warming up water cooled engines in cold weather was recently developed by some of the enlisted personnel of the First Pursuit Group of the Army Air Corps at Selfridge Field, Mich. Difficulty was encountered during the winter maneuvers of the Pursuit Group when attempting to start the D-12 engines of their Curtiss P-1 pursuit planes at very low temperatures. The heater consists of a three gas burner arrangement heating a coil through which the water of the engine's cooling circulates. The burners use gasoline from the airplane tank. The heater is eliminated from the cooling system as soon as the engine functions properly. On the northern trip of the Pursuit Group the engines were started after the heaters had been in operation for about two hours. With more shielding from the wind it is expected that the heaters can be allowed to burn all night at half capacity and the engines started instantly. The entire apparatus fits into a space less than a foot square and is installed under the engine inside the cowling.

International Aircraft Show to Be Held in Chicago, Dec. 1 to 9

THE AERONAUTICAL Chamber of Commerce of America recently announced its plans for an international aircraft show to be held in Chicago next December. At the same time it also announced the formation of the Aeronautical Expositions Corp. of New York City, a subsidiary of the Aeronautical Chamber of Commerce, to handle all aircraft shows to be held under its auspices. This new organization will handle the show in Chicago which, according to present plans, will be held in the Coliseum from December first to ninth. Details are well under way and assurance of cooperation has been given by the aircraft industry of the various European countries. The show will be held in conjunction with the International Aviation Conference called by President Coolidge to be held in Washington Dec. 10 to 17.

Two International Models for pleasure and

In no other ships manufactured today are the demands of the commercial or pleasure flyer so effectively met as in these two International models. And in no other ships produced today are there combined more advanced engineering developments than are represented in the International "Air-Coach" and and International "Sportsman".

International is jealously guarding the reputation for safety, dependability and construction perfection for which International Aircraft are world-famous. Into International Planes are built a quality of construction rare in the industry.

The "Air-Coach"
Model F-18

Six-place enclosed Cabin Cruiser Heated, ventilated, and richly appointed passenger cabin seats five adult passengers with day baggage in Pullman comfort. Open 2-place pilot cockpit accommodates extra pilot or passenger. Passengers and pilot have full unobstructed vision. Full pay load, 1,000 lbs. Wing span, 37 feet. Length overall, 27½ feet. Perfect streamline design. Many striking color combinations or can be furnished to color specifications of purchaser. Designed for any 180 to 300 h.p. motor. Either single or dual pilot control

Fundamentally correct in design—actually years in the van of most other aircraft—International Planes offer the very acme of perfection in present-day craft of the air.

Judge International from any standpoint you will. For performance, speed, stability, maneuverability—for absolute dependability and safety—International has consistently outperformed competitive makes.

Both of these International Planes will be exhibited at the All-American Aircraft Show at Detroit

The INTERNATIONAL AIRCRAFT CORP., (formerly of Long Beach, Cal.) CINCINNATI, OHIO
Pioneers in aeronautics since 1909

that meet all demands commercial flying!

Time and again International Planes have demonstrated their vast superiority for minimum take-off, maximum climbing speed, stability and ease of control. This superiority, basically attributable to the advanced International design, is maintained by the very high International standard of construction. International Planes are "built to a standard—not to a price". That standard is the highest in the industry today.

To the man interested in any type of aircraft, whether for commercial or pleasure use, International's record alone should recommend a thorough investigation of these two marvel ships. For these men, International has just completed a very elaborate illustrated treatise on the "Air-Coach" and "Sportsman". This interesting brochure will be gladly sent free on request.

The "Spartsman"
Model F-17

Three place Combination Sport and Commercial Plane. Roomy upholstered passenger cockpit will accommodate two or three people. Slightly raised pilot cockpit gives unobstructed vision in all directions. Equipped with all the usual instruments a well-appointed plane should have. Wing span 35 feet. Length overall 25 feet. Beautiful sport streamlines, with unlimited choice of color combinations and finish. Can be powered by OX-5, Wright, Hisso, Ryan-Siemens, Anzani, Caminez or other standard motors.

INTERNATIONAL *Aircraft*

Built to a Standard - - - Not to a Price

Navy Tests NY-2 Seaplane Fitted With Handley Page Automatic Slots

THE NAVY Department has been testing a Consolidated NY-2 seaplane fitted with Handley Page automatic slots at the Naval Air Station, Anacostia, Washington, D. C. On this installation, the automatic slots were fitted to the leading edge of the upper wing in front of the ailerons. The rest of the wing was fitted with a manually operated slot interconnected with a trailing edge flap.

It was found that at speeds corresponding to an angle of attack of 10 deg. the automatic slot remained closed and was not fully opened until an angle of 12 deg. was reached. With the slot open and the wing at an angle of 18 deg., which is normally the stalling angle for this wing, the effect of the slots was to increase the lift by approximately 30 per cent. This continues up to an angle of 28 deg., when the lift is increased by approximately 60 per cent.

The dropping of the trailing edge flap has the effect of increasing the camber of the wing which is also advantageous in increasing the lift. It has the further useful effect of appreciably increasing the relative angle of attack so that in order to get larger angles of attack on the wing it is not necessary to depress the tail too far. The Navy Department intends in the near future to apply the full slotted wing to a bombing type of plane to reduce its landing and take off speed. It is stated that the automatic slot will be tested on each type of plane now under contract by experimental installations on one of each type. The operation of the automatic slot was described in AVIATION for Feb. 27, 1928.

Star Air Line, Inc. to Operate At New Seattle, Wash. Airport

THE STAR Air Line, Inc., was recently organized in Seattle, Wash., as distributor for airplanes, operator of a flying school, and operator of aerial taxi and scenic service. The company already is the northwest representative of Thunderbird Aircraft, Inc., and has made formal application for permission to erect the first unit of a series of permanent hangars on the new Seattle Airport at Georgetown. Except for the Boeing Airplane Co.'s activities it is understood that this is the largest aeronautical development at the new field.

Portland, Ore.-Yakima, Wash., Line Is Planned by the Rankin Company

AIRPLANE PASSENGER and express service between Portland, Ore., and Yakima, Wash., will be inaugurated soon by the Rankin Flying Service, Inc., of Portland, J. G. "Tex" Rankin, head of the company, has announced. One round trip daily, six days a week, is contemplated. The service is to be started with a Ryan cabin monoplane carrying four passengers and pilot.

B.B.T. Corp. of America Issues Booklet Entitled "Airport Lighting"

A COMPREHENSIVE 16 page catalogue with 41 illustrations and describing the use of airport lighting equipment has just been issued by the B.B.T. Corp. of America, airport beacon manufacturer, from its headquarters in the Atlantic Building, Philadelphia. "Airport Lighting" is the name of the booklet. The company's various lighting products and their use are pictured and explained in the pages.

Thos. Cook & Son to Use Planes On New Cruise of World in 1929

AIRPLANES ARE to be used, it has been announced, to carry one section of a new Thos. Cook & Son world cruise party to the remains of the pre-historic Greek city of Petra in the hinterland of Arabia. Another group will cross the desert of Palestine in planes to see the ancient metropolis of Jerash, one of the 10 cities founded by Alexander the Great, while Bagdad, Babylon, and the Tower of Babel will also be visited in this way. Camping outfits will be carried in the airplanes, thus enabling the passengers to sleep out on the desert beneath the wings of the craft.

The Cunarder *Franconia* has been selected by Thos. Cook & Son for the world cruise which will offer the trips by airplane. The steamer will sail from New York on Jan. 15, 1929, returning to that port on May 31.

New Flying School is to Operate From Roosevelt Field, Long Island

A FLYING school is to operate from Roosevelt Field, Long Island, N. Y. This field, made famous by many trans-Atlantic flights last year, has heretofore been used by commercial aviators, though no hangar space was available or regulations enforced. A few years ago two hangars were built, but these have not been available to commercial operators. Recently a portion of the field was purchased by the Meadow Brook Country Club, nearby, who will use the tract as a polo practice field. There is enough left for an ample landing field though it will be necessary to move the runway slightly to the south. The new runway will be the same length as the old one, or nearly a mile. It is understood that J. J. Lannin, owner of the field, and Lieut. Henry B. Clark are to operate the school with Clark as manager of the field. Four planes have been purchased and office space is being partitioned off in one of the hangars.

Receive Entries of Seven Nations For Gordon Bennett Balloon Race

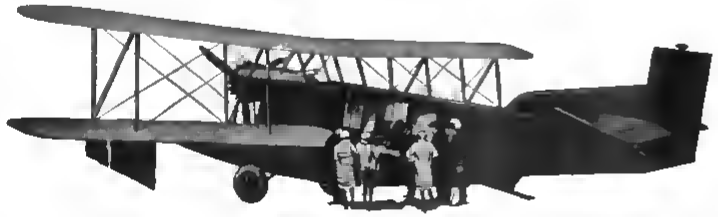
SEVEN COUNTRIES had entered the Gordon Bennett International Balloon Race to be held from Detroit June 30, as AVIATION went to press. Three balloons have been entered by the United States, which placed first last year with a team composed of E. J. Hill and A. G. Schlosser. France and Belgium have also entered three, while other nations which will be represented are Switzerland, Great Britain, Denmark, and Argentina.

The National Aeronautic Association has taken charge of the entries for the great lighter than air competition.

Whitby Sets Record by Dropping 4100 ft. Before Pulling Rip Cord

HAROLD L. WHITBY, machinist's mate, U.S.N., recently set, what is believed to be, a new record when he jumped from a plane at an altitude of 5,100 ft. and waited until he had dropped 4,400 ft. before he opened his parachute. It is understood that the previous record, held by the Army, was 2,300 ft. From other planes at the same altitude as that carrying Whitby, Theodore Morgan and Thomas L. Crawford jumped and waited until they had fallen 3,000 ft. and 2,700 ft., respectively, before opening their parachutes.

FOR EVERY COMMERCIAL PURPOSE - OVER LAND AND SEA



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THE LOENING CABIN AMPHIBIAN

AFFORDING the commercial and private operator a variety of airplane possibilities and usages of more complete scope, justifying the higher first cost by economy in the long run, due to wider use and longer life.

EQUIPMENT - Muffler, heater, electric inertia starter, Standard Steel Propeller, complete cabin furnishings, triplex glass, lights, toilet, baggage holds, anchor and line, all instruments, including compass and turn indicator, double fuel pump system, fire extinguishers, wheel brakes (optional), pilot's compartment and passenger seating capacity normally for four but can be arranged for six

PERFORMANCE - 120 miles per hour, high speed, 14,000 feet ceiling, with 140 gallons gas, 12 gallons of oil, pilot, and equipment and 1200 lbs pay load

Price — Delivered for flight, New York — $24,700

LOENING AERONAUTICAL ENGINEERING CORPORATION
31ST STREET AND EAST RIVER, NEW YORK CITY

LOENING

MORE THAN 100 Loening Amphibians have flown over 2,500,000 miles in all parts of the world and in all climates and the work that has been done by this unique plane for the United States Government in the Army, Navy, Marine Corps and Coast Guard Air Services during the past four years has well earned the title of "The Plane That Does The Hard Work For America".

FROM THE very inception of its development the Loening Unit Hull type, which is patented, has always been an Amphibian — logical in its design — extremely convenient and efficient in its layout and after long experience entirely perfected in its surprisingly normal, easy and stable flying qualities. There has been an occasion in the development of this outstanding airplane type for after thoughts of adding floats to a land plane or adding wheels to a float seaplane. The Loening type, is actually the first *real* Amphibian and practically the only Amphibian available today with any serious amount of service behind it to insure its satisfactory operation and its status as an already finished product.

Available now for commercial, civil and private use, the Loening Cabin Amphibian is a sensible and practical development of the Government planes and incorporates all of the characteristics, and perfections that hard experience and constant usage of the past have developed.

ABILITY AS A STURDY LAND PLANE of this type is such as to permit its use continuously from Inland Fields of even a very rough character. The take-off with the air cooled engine is quick and the wing loading is light. Usage, which is the real test, has proven that there is ample ground clearance of the keel and never has the Loening Amphibian suffered from limitations on this score, particularly as the keel itself is so greatly reinforced that actual land landings have often been made with the wheels up with no injury. The Cabin Amphibian, itself, as a land plane is a normal tractor biplane of the most widely used land type, with large wheels and tires and easy cabin access.

SEAWORTHINESS AS A FLYING BOAT of this airplane has been found surprisingly good under the most difficult conditions. The hull has been made very strong and serviceable with its Loening type of composite metal covered construction and with the water-tight nose there is no possibility of shipping water in breaking seas, as in a "pusher" flying boat. The propeller in front immediately rises well clear of the water under way and is far ahead of the spray, as well as protected by the hull beneath it and yet, experience and usage (which again is the only real criterion) show constantly that the tractor arrangement, as desirable for every flying and safety reason, has an disadvantage in comparison to the older type of "pusher" boats, (yet gets away from having the engine poised back of the passengers). Upon coming to a mooring the forward position of the pilot enables him to pick up a line, either from his seat or from the lower wing, and with propeller still running this line is fastened to the side chock. As soon as the propeller is stopped it is transferred to the bow, if desired, for a heavy blow. The ease with which anchoring and mooring operations can be taken care of by merely bringing the mooring to the side of the hull has been a revelation.

With the propeller stopped, passengers can be taken aboard at the bow and have access to the cabin with steps that are provided, in quite as easy a manner as any other type and with line again merely transferred from the bow to the side chocks the pilot is able to start his engine and warm it up before casting off and can cast off his line or raise his anchor without the slightest difficulty while running his engine.

AIRWORTHINESS AS AN AIRPLANE — of the Loening Amphibian has been developed to a state of perfection where it is admittedly today one of the finest flying airplanes of any type now in service. Whether over land or water, wheels up or down, this surprisingly versatile plane proves to be a perfect flying machine, stable in rough air, handy and normal on all controls and easy to land and taxi.

THE AIR is over everything and is a highway with access to all places, but the airplane can only be considered to have really started on its dominating career when it is endowed with ability to land and operate from both land and water. This time has now arrived. And an even bigger, more sensible and more practical era of flying opens up before us.

LOENING AERONAUTICAL ENGINEERING CORPORATION
31ST STREET AND EAST RIVER, NEW YORK CITY

Stinson Aircraft Corp. is Using New Type Control on its Planes

A NEW type of control is now standard on planes produced by the Stinson Aircraft Corp., Northville, Mich. It is a dual side by side wheel control of simple design that leaves the cockpit free from obstructions. Each wheel is mounted on a horizontal, tubular shaft supported by an O and S universal bearing. The bearing allows a fore and aft motion of the shaft which is connected to a long bell crank that actuates the elevators through push pull rods. In addition the bearing allows a certain pitching motion of the shaft to accommodate the rise and fall of the bell crank control, as well as the rotational movement of the shaft for the aileron action. At the end of the shaft a small gimbal joint is provided and at this point the shafts of each control arm connected by a horizontal tube. Bronze bushings carry the sprocket over which the aileron control chain runs. This chain is connected to a cable which runs behind each rear wing spar to where it is pinned to a push pull rod connected directly with the aileron. The stabilizer control has been changed from the left side to the center so that it will be more convenient for both instructor and student. The adjustment of the stabilizer is accomplished by a single motion of the lever and is locked in position by a ratchet.

The rudder pedals are conventional with those on the left fitted with the heel type wheel brake control. The brake mechanism is conventional, being simply a cable along the underside of the fuselage and hence down the landing gear strut to the brakes. The position of the fulcrum is such that the neutral position of the heel brake rises as that particular rudder pedal is depressed. Since it is desirable to apply the brake on one side at the same time as the rudder on that side is depressed, the brake control is so arranged that the pilot may get the full sweep at the heel pedal. In this way, the action of the brake is more pronounced.

Maryland Metal Building Co. Forms Special Airport Equipment Division

AS A means of rendering a specialized building service to the aeronautical industry, the Maryland Metal Building Co. of Baltimore, Md. has formed a separate organization, known as the Airport Equipment Division. Headquarters will be in Philadelphia, Penna. and Lieut. C. William Close, a former United States Air Service pilot, is in charge.

The Maryland Metal Building Co. has been a pioneer in serving the building needs of the aeronautical industry. During the Sesqui-Centennial Exposition, this company erected for the Philadelphia Rapid Transit Co. a hangar to house the three Fokker Tri-engined planes used on the Philadelphia-Washington-Norfolk line. Later, when the question of a municipal airport for Philadelphia was under consideration, the Maryland Metal Building Co., represented by Lieutenant Close, cooperated with C. Townsend Ludington and other interested parties. After a site had been selected, they laid out a comprehensive building program designed to take care of the building requirements for several years to come. Several of the structures called for by this building plan have already been erected, and the Philadelphia Airport is now being operated under lease by the Ludington Philadelphia Flying Service. The completed buildings include two hangars 70 x 100 ft., a large experimental shop 40 x 200 ft., a machine shop 20 x 200 ft., a photographic room, a woodworking shop, a dope house, and a club house.

As a result of the experience gained in the building of the Philadelphia Airport, the Maryland Metal Building Co. decided to form a separate division to devote its entire energies to serving the aeronautical industry. The Airport Equipment Division is designed to render a consulting service besides acting as selling agents for Maryland metal buildings. By studying the present and possible future needs of an airport, they will recommend the type and number of buildings required. The activities of the Airport Equipment Division are not confined to the building needs of airports, for it serves manufacturers of aircraft and accessories as well.

The Airport Equipment Division has already completed a hangar and assembly shop for the Keystone Aircraft Co. of Bristol, Pa. The building is 80 x 80 ft. and is to be used for assembling and storing the Keystone bombing planes which are being built for the United States Army. It is of structural steel frame covered with sheet steel.

Canadian Vickers, Ltd. Completes Tests on Plane for Forest Service

TESTS were recently completed by Canadian Vickers, Ltd. of Montreal, Can. on a forest patrol type of biplane to be known as the "Vigil". The plane is powered with a Wright Whirlwind engine and because of the wide temperature ranges under which it must operate, it is constructed with no wires or cables in the entire structure. The structure is of metal except for the upper wing, which is of wood covered with fabric. The upper wing is much larger than the lower one, having almost twice the span. Struts from the midpoint of the lower wing are connected to the upper wing and to the fuselage. The landing gear is also supported from this point, making a very rigid form of trussing resembling a Warren truss for interplane bracing. It is a single seater, equipped with radio, but it can be fitted with dual control or converted as a mail carrier very easily. The first model was tested on floats, but provision has been made for the installation of wheels or skids for land operations.

The plane presents a clean cut appearance and has a wing span of 35 ft. 3 in. Overall, the plane is 27 ft. long and 10 ft. high. It is stated to have a top speed of 125 m.p.h., a landing speed of 50 m.p.h., and service ceiling of 18,000 ft. The Vigil weighs 1,505 lb. empty and 2,250 lb. loaded. This allows a disposable load of 745 lb. which includes 62.6 gal. of gasoline.

Bristol Jupiter Engines Now Fitted With Farman Type Reduction Gears

FARMAN TYPE reduction gears are now fitted to British Bristol Jupiter Series VIII and IX engines, developing 455 hp and 485 hp, respectively. These gears have been under tests in various types of planes for the last year and a half and have shown extremely high efficiency. It is understood that, in this country, experiments are underway on both Wright Cyclone and Pratt & Whitney Hornet engines using reduction gears to reduce the propeller speed below that of the crankshaft.

Reduction gears have been proven to increase propeller efficiency by permitting the propeller to be designed for a more efficient speed. This characteristic is especially noticeable in the take off or climb of a heavily loaded plane. In England most of the large bombers and heavy transport planes are powered with Jupiter engines equipped with reduction gears, while in this country the only geared engines in regular service are water cooled designs.

Landing Planes of Every Description in Restricted Areas

On All Kinds of Buildings, Railway Terminals, Steamships and Piers

Naval and Commercial Flying Made Practical by The Gibbons Landing and Launching Devices

THE chief advantage of commercial aviation lies in its ability to carry passengers, merchandise and valuable papers at a greater speed than that of forded by the present method of transportation. However, much of this advantage is lost at present, because of the time lost in landing in the heart of the city or place of destination.

We take pride in promoting international aviation with the same spirit as Colonel Lindbergh, with no mercenary purpose. This, our friends in the aeronautical line can verify. We have received offers from several lines which we have ignored.

We do not advertise for the purpose of enlisting capital, holding companies, promotion schemes, or forming or organizing subsidiary companies. In short, if our devices prove meritorious and any person or firm is to be built them at their expense, we will work on a royalty basis, and charge for the supervision of the building of whole or part of any of these devices which might be used. If any person, firm, municipality or government is willing to build part or whole of any one of our devices, when we prove without doubt the practicability of our service, well and good; *if not, no harm is done.*

We have eight of the cleverest men in their respective lines on our Advisory Board. None of the trans-atlantic fliers are on this Board.

We believe that these devices will be the cause of preventing countless accidents, thereby saving life and limb.

During 1926, at a dinner to the presidents of four of the best known scientific and educational men in the country, one of whom is internationally known in the aeronautical line, the inventor of this device, Mr Gibbons, the first to sponsor the landing of planes on buildings and ships, stated that he had spent much time and money since 1919 for the purpose of advancing aviation and he intended to spend the balance of his life up this course. They congratulated him for the spirit that prompted such an interest.

Ocean liners can have two landing and launching devices of our type to land and launch planes or seaplanes. These devices will not cover the entire deck. Aside from these devices, we have something new for the airport (a missing link) that the pilots will welcome and appreciate.

Admiral W. A. Fullam on November 10th, 1924, made the following remarks "I foresee the carrying of planes by ocean liners to leave the ship when near land with express mail and passengers, saving a day or two. Landing decks on ships with passengers not satisfied with good-sized streamers are perfectly feasible."

The above illustration shows the proposed building designed to accommodate our devices. A section of the building is of our story with cellars and foundation. The first story is occupied by us as our office and plant. This proposed building will be located one mile from the Brooklyn Main Post Office, the Borough Hall, the financial district, two hundred feet from the Sub Post Office Station "A", and three quarters of a mile from Governors Island.

Arthur Brisbane in his editorial on September 13th, 1925, said: "Not far in the future will come the new City, one building devoted to one single business with a landing roof. The congested traffic problem may be solved from the roof leasure it is solved in the streets."

Secretary Hoover in Washington, D. C., on December 9, 1927, remarked before five hundred aeronautical leaders and honored men, that not far in the future communications between one hotel and another will be by airplanes, and an group of men in doing more to support both commercial and government airplane activities than the hotel men of the country.

Rear Admiral William A. Moffett is quoted as follows in the New York Times of February 5th, 1928: "It is entirely feasible and permissible to fit landing decks on top of merchantmen, which will permit very effective operation of aircraft of great potential striking power, and defensive ability. Taking off from decks as four-day speed will be provided with air transport that will shorten the time possibly by still another day."

The Brooklyn Daily Eagle of February 12th, 1928, said: "Mr. Gibbons' plan is unique to say the least, and yet not only engineers, but the Post Office Department and many railroads have the utmost confidence in his project. It appears certain that ultimately such landing facilities will be located on the roofs of both Brooklyn and New York Post Offices and many of the down town office buildings, as well as railroad stations."

In a radio talk broadcasted from Station WJZ, on May 9th, 1924, at 7:30 p.m., Major L. D. Gardner of New York City, Publisher of "Aviation" said in part: "An engineer by the name of Gibbons in Brooklyn has a landing and launching device so efficient that it can be used to land and launch airplanes on roofs of buildings. By this means you may soon be able to land or take off in an airplane from the roof of a building over your home. Won't that be a great convenience?"

William H. Cox stated in the April, 1928, issue of Air Travel News, Detroit, Mich. "It wont be long until landing fields will be established on skyscrapers."

Our staff since 1919 was composed of naval, electrical, mechanical, aeronautical and structural engineers and pilots, in conjunction with engineers of our own and foreign governments. Some of the members of this staff have covered most of the flying fields and airplane manufacturing plants of the United States, Canada and Europe; in fact, they came in contact with everyone who is prominent in the science of Aeronautics. In this manner, valuable information was collected which was important in enabling us to perfect our devices.

We do not use catapults. Our devices enable the standard make of plane or amphibian to land or launch with their own power.

Our devices will only be twenty to twenty-five feet in diameter at the base for scouting planes, and forty-five to fifty feet at the base for bombing planes up to 10,000 pounds in weight—a space saver. The recoil short run or take-off of planes enables our devices to be cut down in cost, weight, and size, and also simplifies their construction.

The devices can be automatically turned into the wind by means of a wind vane operating electrical contacts. The devices can be operated to any desired angle to the horizontal. They have a day and night signal system, including an up-to-date night flying lighting system, and what is more, a system of heating the platform and a unique method of removing the snow from the platform by mechanically operated arrangements. A system of suction or vacuum underneath the platform controls the wind wash and changing currents and also removes an granulated form, from zero upwards, the bank of air under the plane when landing to avoid the bouncing *and* bopping around. These are also guide cables to guide the plane, and means of retarding the plane after landing is really a new feature.

Planes can be received and launched at intervals of every five minutes, whether on roof or steamship landings.

The devices are constructed so that the plane is always able to land against the wind. Means are provided to remove the air form underneath the wings of the plane, thus causing the plane to rest firmly on the surface of the device. Suitable guides are provided; further several tog devices are the landing on an incline, also spring retarders, etc., which greatly increase the friction form on the tail skid and wheels of the plane.

The controls of the devices are located in two pilot houses, one pilot house in reserve, which are located at the end of the platform. The controls are interlocking with visible and landing signals so arranged that operations can be carried on only in one pilot house, but should any controls fail, the second operator can take over them immediately.

The controller from his pilot house operates an automatic control which is attached to the wind vanes, so that the device is always headed into the wind unless otherwise desired by the operator.

Patents have been secured in all the principal countries of the world and the inventions are thus fully protected against infringements.

They are adaptable to all kinds of buildings, railroad stations, terminals, ocean liners, battleships, airplane carriers, navy yards, piers, ferry slips, storehouses, post offices, municipal buildings, armories, fortifications, hangars, office buildings, hospitals, hotels, fire houses, factories, planks, pleasure resorts, rock or wooded countries, and for coast defenses on the coast principles on the disappearing guns, etc.

Our seven types of landing and launching devices may be used in whole or part to meet a great variety of requirements.

Philosophy provides for contingencies which formulae never does. Force of character and indomitable perseverance are the things that win. Colonel Lindbergh and Clarence Chamberlin proved this.

Platforms can be used in battery formation or groups where space is available. The most important point about the devices is that they can be made to handle any size of plane from the smallest up to a giant airliner of 20,000 pounds weight, without any alterations in their basic construction by simple adjustment of the automatic equipment of the platform.

Every step of the development has been checked by calculations, wind tunnel tests, and by the use of an accurate one-quarter-inch scale working model in which all the basic conditions were successively reproduced. This accurate working model of the device has won the approval of numerous authorities, such as aeronautical engineers, pilots, air transport operators and other competent men.

Some of these devices can be operated at a distance of five miles from the platform for land use.

Manufacturing efficiency demands the economical movements of maximum quantities of material in the quickest way and with the fewest possible moves. This can be done with the plane and what goes with it.

Aviation is knocking at our door now

Only responsible authorities (in good faith) on research or inquisitions, etc., will be considered.

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Near Hamilton Avenue
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State Tour and a New Service Announced by Grand Rapids Club

PLANS CALLING for an aerial tour of Michigan by Grand Rapids plane owners, the establishment of a Reserve Officers aviation base at the Grand Rapids Airport, and the inauguration of a new aerial transport service to operate from the local airport were recently announced by Carl T. Batts, president of the Grand Rapids Flying Club. The aerial tour will call at various cities throughout the state.

The new aerial transport service will operate a five place cabin airplane and a three place open plane in its service. The corporation will also operate a general flying school. Capitalization is $50,000 with a paid in capital of $25,000.

The county board of supervisors has appropriated $5,000 for the improvement of the runways at the airport. The Flying Club will undertake to provide funds for lighting the field for night flying. This will include the installation of beacons and flood lights.

REVIEWS

N.A.C.A. publications may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

N.A.C.A. Report No. 274. The N.A.C.A. Photographic Apparatus for Studying Fuel Sprays from Oil Engine Injection Valves and Test Results from Several Researches, by Edward G. Beardsley. Apparatus for recording photographically the start, growth, and cut-off of oil sprays from injection valves has been developed at the Langley Memorial Aeronautical Laboratory of the N.A.C.A. The apparatus consists of a high-tension transformer by means of which a bank of condensers is charged to a high voltage. The controlled discharge of these condensers in sequence, at a rate of several thousand per second, produces electric sparks of sufficient intensity to illuminate the moving spray for photographing. The sprays are injected from various types of valves into a chamber containing gases at pressures up to 600 lb. per sq. in.

Several series of pictures are shown. The results give the effects of injection pressure, chamber pressure, specific gravity of the fuel oil used, and injection-valve design, upon spray characteristics.

N.A.C.A. Report No. 273. Wind Tunnel Tests on Autorotation and the "Flat Spin", by Montgomery Knight. The report deals with the autorotational characteristics of certain differing wing systems as determined from wind tunnel tests made at the Langley Memorial Aeronautical Laboratory. The investigation was confined to autorotation about a fixed axis of the plane of symmetry and parallel to the wind direction. Analysis of the tests leads to the following conclusions:

Autorotation below 30 deg. angle of attack is governed chiefly by wing profile, and above that angle by wing arrangement.

The strip method of autorotation analysis gives ascertain results between maximum C/L and 35 deg.

The polar curve of a wing system, and to a lower degree of accuracy the polar of a complete airplane model are sufficient for direct determination of the limits of rotary instability, subject to strip method limitations.

The results of the investigation indicate that in free flight a monoplane is incapable of flat spinning, whereas an unstaggered biplane has inherent flat-spinning tendencies.

The difficulty of maintaining equilibrium in stalled flight is due primarily to rotary instability, a rapid change from stability to instability occurring as the angle of maximum lift is exceeded.

N.A.C.A. Report No. 277. The Comparative Performance of an Aviation Engine at Normal and High Inlet Air Temperatures—by Arthur W. Gardiner and Oscar W. Schey. This report presents some results obtained at the Langley Memorial Aeronautical Laboratory of the N.A.C.A. during an investigation to determine the effect of high inlet air temperature on the performance of a Liberty 12 engine. The purpose of this investigation was to ascertain, for normal service carburetor adjustments and a fixed ignition advance, the relation between power and temperature for the range of carburetor air temperatures that may be encountered when supercharging to sea level pressure at altitudes of over 20,000 ft. and without intercooling when using plain aviation gasoline and mixtures of benzol and gasoline.

The results show that for the conditions of test, both the brake and indicated power decrease with increase in air temperature at a faster rate than given by the theoretical assumption that power varies inversely as the square root of the absolute temperature. The observed relation between power and temperature when using a 30-70 blend of benzol and gasoline was found to be linear.

N.A.C.A. Report No. 272. The Relative Performance Obtained with Several Methods of Control of an Overcompressed Engine Using Gasoline—by Arthur W. Gardiner and William E. Whedon. This report presents some results obtained during an investigation to determine the relative performance characteristic for several methods of control of an overcompressed engine using gasoline and operating under [illegible] conditions. For this work, a special single cylinder test engine, 5 in. bore by 7 in. stroke, and designed for ready adjustment of compression ratio, valve timing and valve lift while running, was used.

The following comparative results are based on the optimum performance for the engine obtained with non-detonating fuel at a compression ratio of 4.7. The power and fuel consumption with full throttle, but retarded ignition, remained substantially constant at the higher compression ratios, the order of ignition timing permitting full throttle operation ranging from 30 deg. at 4.7 to 3 deg. at 7.3; exhaust temperatures, heat loss to the cooling water, and explosion pressures at the higher ratios were normal. At the compression ratio of 7.5, the power obtained when throttling the carburetor to control detonation was about 39 per cent. less and the fuel consumption was considerably lower. With detonation controlled at full throttle by retarding the ignition with time of inlet valve opening constant and time of inlet valve closing varied, the power was about 23 per cent. less and the fuel consumption was greatly increased. By varying the timing of the inlet valve to reduce the effective compression ratio time of inlet valve opening and closing varied simultaneously, the power was about 29 per cent. less and the fuel consumption was greatly increased.

N.A.C.A. Report No. 278. Lift, Drag, and Elevator Hinge Moments of Handley Page Control Surfaces, by R. H. Smith. This report combines the wind tunnel results of tests on four control surface models made in the two wind tunnels of the Navy aerodynamic laboratory, Washington Navy Yard. The purpose of the tests was to compare, first, the lifts and the aerodynamic efficiencies of the control surfaces from which their relative effectiveness as tail planes could be determined; then the elevator hinge moments upon which their relative ease of operation depended. The lift and drag forces on the control surface models were obtained for various stabilizer angles and elevator settings in the eight foot tunnel by the writer in 1922.

N.A.C.A. Report No. 279. Tests on Models of Three British Airplanes in the Variable Density Wind Tunnel by

George J. Higgins, W. S. Diehl, and George L. DeFoe. This report contains the results of tests made in the N.A.C.A. variable density wind tunnel on three airplane models supplied by the British Aeronautical Research Committee. These models, the BE-2E with R.A.F. 19 wings, the Bristol Fighter with R.A.F. 15 wings, and the Bristol Fighter with R.A.F. 30 wings, were tested over a wide range in Reynolds Numbers in order to supply data desired by the Aeronautical Research Committee for scale effect studies.

The maximum lifts obtained in these tests are in agreement with the published results of British tests, both model and full scale. No attempt is made to compare drag data, owing to the omission of tail surfaces, radiator, etc., from the model, but it is shown that the scale effect observed on the drag coefficients in these tests is due to a large extent to the parts of the models other than the wings.

N.A.C.A. Report No. 275. The Effect of the Walls in Closed Type Wind Tunnels, by George J. Higgins. A series of tests have been conducted during the period 1925-1927 by the N.A.C.A. in the variable density wind tunnel to determine the effect of tunnel-wall interference and to determine a correction which can be applied to reduce the error caused thereby. The use of several empirical corrections was attempted with little success. The Prandtl theoretical corrections give the best results, and their use is recommended for correcting closed wind tunnel results to the conditions of free air.

An appendix is attached wherein the experimentally determined effect of the walls on the tunnel velocity very close to their surface is given. This is of special interest because a "scale effect" was found in the boundary layer with a change in the density of the tunnel air.

Circular of the Bureau of Standards No. 346. Light Metals and Alloys, Aluminum and Magnesium. Price $1.10. Obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C. With the increasing use of light alloys, notably aluminum and magnesium, for aircraft construction as well as in other industries there has been a considerable demand for accurate information on the properties, statistics, and manufacture of these metals. In 1919 the Bureau of Standards issued a circular on the subject which has been revised and brought up to date in the form of circular No. 346. A mass of information has been sifted and condensed and much of it is presented in the form of 115 tables and 113 figures in this circular. The physical mechanical properties of aluminum and magnesium and their light alloys are given with the variation of the properties caused by changing the composition of the alloys by the presence of impurities, mechanical working, by mechanical working, by changes in conditions of manufacturing operations, and by heat treatment. In addition metallography, corrosion resistance, and methods of protection against corrosion, the theory of heat treatment, and the application of the alloys to industry are discussed. There is also a classified bibliography of close to 3000 titles appended.

Sell the Foreign Markets

Continued from page 977

tary or civil air services or non-manufacturing countries, our manufacturers will find it worthwhile to send their products with highly capable men to demonstrate their superior qualities. Properly qualified men will find government officials and others whom they wish to interest willing to give consideration to their proposals. This is true also in countries where airplanes have not been introduced.

After our men have kept a few planes operating in good condition for a time, they can sell engines, parts and supplies for maintenance and new planes for training, new air services, flying clubs and individual use. A few good transportation men could aid in determining where commercial services are justified and in building up traffic. Cooperation along these lines among manufacturers is certain to benefit them as it has automobile, tire and road-building machinery manufacturers.

Each manufacturer has individual problems to be solved and their working out will be influenced by the product to be sold, the market to be supplied, the capital available, the ability of the organization's personnel and lesser items. A large manufacturer has formed a subsidiary export corporation; another may employ an export commission agent and a third may select native agents in foreign countries. Foreign sales may be handled by the domestic selling and shipping organization or by a separate export department. One of the vice presidents may have an aptitude for handling the exporting end of the business successfully.

Should Study Foreign Market Needs

Probably a high officer of the company, capable of the work, should be responsible for an export department. Some of his duties would be to learn the needs of his chosen foreign markets to select highly qualified men (Americans) to represent him abroad, to supervise their work and support and assist them carefully, to look after selling terms and collections, to supervise the clerical assistants handling the paper work and to see that the production and shipping departments turn out and ship at the time promised exactly what has been ordered for the foreign purchasers.

Better results can be obtained by maintaining an organization abroad to maintain relations with government officials and others interested in aeronautic developments, demonstrate the products' uses, sell, help maintain the equipment sold and serve generally the exporter and users of his products.

Exporters of parts, appliances and even of some types of aircraft may find it advantageous to employ the export department of another manufacturing exporter who maintains an export department and who handles aircraft or other products which do not compete with theirs. Several small manufacturers can form an export corporation to handle all their products. It will be necessary to consider the circumstances in each case in order to determine the best way to organize and operate successfully in the exporting business.

Financial Advice Valuable

The question of terms and discounting buyers' obligations will be influenced by the exporting company's capital available for financing export shipments, the persons to whom they sell, and related points. A good credit agency or the exporter's bank should be consulted with regard to the credit standing of possible customers and the terms upon which sales may be most profitably and safely made. The advice of bankers is very valuable in settling all these questions.

One of the problems not met with in domestic business is the time needed for correspondence between the exporter's office and his agency abroad or his foreign customers. Patience will be necessary in making all details and other important points clear to the man abroad, especially when he is the foreign purchaser. It is the exporter's duty to explain fully his product, his terms, and every other detail which may be inquired about by foreign prospective purchasers. Absolute honesty and square dealing are essential to build up and maintain sales.

The resulting increase in business and the prospects for a constantly enlarging movement of aeronautic products to a

large number of countries throughout the world will amply repay the necessary efforts which may be given to the development of export trade. The automotive industry is a shining example of the success of American manufacturers who are willing to meet the requirements of people in foreign countries in need of improved facilities for transportation. The field for the aeronautic manufacturer is practically unlimited and we cannot visualize the prospects fully.

Detailed Information Available

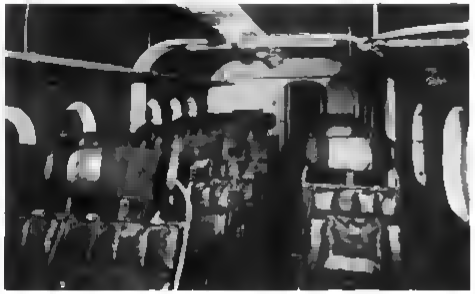
The Bureau of Foreign and Domestic Commerce maintains a head office in Washington and 23 district offices in the principal centers of business throughout the country from which detailed information regarding foreign markets, the customary methods of packing, financing, shipping and other details can be obtained. The Bureau is constantly collecting information from its 51 foreign offices and all the American consular officers in foreign countries and this is distributed to American manufacturers regularly. Confidential information is distributed promptly to those on the Bureau's Exporters Index. This valuable service can be had by American firms by applying to the Bureau or any of its district offices and all manufacturers of aircraft, engines, parts, equipment, etc., would probably find it advantageous to use the Bureau's services.

The Short "Calcutta"

Continued from page 976

stainless steel, the entire structure is of anodically treated duralumin.

The external shape of the hull is the result of considerable testing in the model tanks at the Rocheste: Works of Short Bros., Ltd. These tests were checked later by full scale tests on a number of full size hulls. Below the waterline, the hull is almost identical to that of the Short Singapore. It is of two-step design, having a concave V bottom and rear step of the closed or faired type to reduce the air resistance. In



Interior view of the cabin of the Calcutta, which seats 16 persons; 15 passengers and one steward

plan the hull is quite streamline with the widest section at the chine, in front of the forward step. Above the chine the hull is almost rectangular in section to provide for the large passenger cabin. Behind the cabin, it takes an elliptical section, tapering to a point at the tail. The hull is very clean with practically no breaks in its lines. The upper part, above the cabin, is rounded at the top, while the sides are curved with a large radius where they meet the chine. Instead of the usual upward curve near the stern, to raise the tail, the upper deck is practically flat from bow to stern. Unlike many flying boats, this one has an exceptionally deep cabin, making it unnecessary to increase the height of the deck at the tail. The hull is said to be unusually seaworthy, being watertight and able to withstand operations in a heavy sea. Afloat it might be compared to a small yacht.

The structure of the hull is designed so that the covering or skin takes the major part of the stress. It is constructed entirely of duralumin except for the fittings which are of stainless steel. To give the hull its proper shape in cross-section, transverse frames are employed. The frames are of

Interior view of the hull behind the cabin section. (Courtesy of FLIGHT.)

I section built up of two duralumin channels riveted back to back. They are bent to conform with the external shape of the hull and an cross bracing is used; this gives a hull interior devoid of all obstruction. The frames vary in size according to the loads imposed on them. At the point of attachment of the lower wing spars they are somewhat heavier than the rest and extend into the cabin a short distance. Similarly, at the point of attachment of the tail surfaces they are somewhat heavier. There are no longitudinal beams, as the covering is depended upon for longitudinal strength. However, attached to the covering are light longitudinal stringers which serve only as local stiffeners. They are only between the transverse frames and do not go through them. These stringers are of flanged V section with flanges riveted to the skin covering. The covering of the hull is riveted in place and is of sheet duralumin varying in thickness according to the stress. The bottom covering, especially the steps, is heavier than at the sides. Local stiffening is also increased on the bottom to withstand impact loads as the result of heavy landings. It is understood that there is no packing between the overlapping sheets of metal; the metal connection between the sheets is claimed to be sufficient to insure water tightness. To divide the hull into water tight compartments, bulkheads are provided across the lower parts of the transverse frames. They are of such height that in the event of a leak the upper edges will be above the waterline confining the leaking water to that section of the hull.

Except for the light longitudinal stringers, the entire structure is of open sections with all major parts accessible from the inside. The interior is visible for inspection and can be kept clean, thus reducing the possibility of corrosion. Except for the steel fittings, the entire structure is of duralumin treated with the anodic process and afterwards painted in a special manner evolved by Short Bros. The company has

been protecting duralumin from corrosion by this process for several years and states that the upkeep of these metal boats costs less than of those constructed of wood. In addition, there is no water soakage which takes place in wooden hulls, adding to the weight of the hull and thus reducing the pay load. Duralumin, it is known, weighs less for a corresponding design strength than wood and Short Bros. claims that it has found this type of construction the most economical from the point of view of obtaining the greatest strength for a given weight. Material that would otherwise constitute the longitudinal members can be added to the skin covering which consequently can be made heavier and less liable to local damage. It has been found that in the case of local damage new duralumin sheeting can be riveted in place quickly and at low cost. This system of construction allows an unobstructed interior for the accommodation of passengers, crew and equipment and at the same time lends itself to mass production. It is stated that the hull is built in separate units and "afterwards joined together in a simple manner."

The wing tip floats follow the lines of the hull except that they are of single step design. They were developed in the Short test tank and provide the proper righting moment with the minimum of resistance. The floats are attached to the wing by five struts braced with wires, three struts are connected to the front wing spar and two struts to the rear wing spar. The struts straddle the interplane strut fittings on the spars except for the extra forward strut which is attached at the fitting and runs diagonally to the rear of the float. The floats are light and amply strong to withstand heavy work.

Fitted With Towing and Mooring Eyes

The boat has been fitted with the necessary towing and mooring eyes situated on the wing tips, bow and stern of the hull. It was designed to be towed at 15 knots (17.27 m.p.h.) with a 15 knot (17.27 m.p.h.) side wind. In the very nose of the hull is a compartment for mooring equipment including one ground anchor, two sea anchors, rope, boat hooks, etc. Behind this is the pilot's cockpit fitted with dual side by side control. The controls and seat on the port side are fixed, while on the starboard side the controls can be removed and the seat folded. With the controls removed and the seat folded, easy access is afforded to the bow from the cockpit. The cockpit is very roomy and like most European commercial passenger planes is open, protected only by a large windshield. This is fitted with automatic wipers for use in case of rain. Excellent visibility in all directions is obtained and the engine instruments mounted on the struts below the engine nacelles are plainly visible. Behind the cockpit on the starboard side is the navigator's compartment, separated by a rolling door. This compartment contains the radio apparatus in addition to a seat, table, drawers, map shelves, instrument lockers, etc. The radio apparatus includes a Marconi AD 6 set having a range of from 300 to 400 mi. using continuous wave telegraphy. For telephony, the range is from 200 to 250 mi. and for Tone Train telegraphy from 240 to 280 mi. Remote radio control can be fitted to enable the pilot to use the radio if desired. For use on the surface there is an emergency aerial on a telescopic mast attached to the upper wing and for radio direction finding Bellini-Tosi loops are provided. The navigator's compartment is fitted with portholes providing light and ventilation. For night flying there is a dome floodlight.

Aft of this compartment and separated by a sliding door, is the main passenger's cabin, 17 ft. long, 6 ft. 6 in. wide, and 6 ft. 3 in. high. At the forward end, and the portside, there is a door or hatchway. On the door or hatch, which is on hinges outward, are fitted steps facilitating entrance to the cabin. In addition, a narrow deck is fitted to the hull near the hatch, so that the passengers can step from this to a dock without the use of a small boat. In the cabin there are three longitudinal rows of seats. Two of the rows are placed together on the starboard side with an aisle between them and the third row, which is on the port side, thus the aisle is slightly off center. The seats are constructed of duralumin tubing, upholstered with kapok preserver cushions which are easily detachable from the seat by unfastening a strap. The seats are quite light, weighing only two pounds each without upholstery. Attached to the back of each seat is a folding table for the use of the occupant behind. At the front of the cabin is an instrument board visible from the seats.

Port wing engine. Note crane used for lifting engine in and out of the flyingboat. (Courtesy of FLIGHT)

Through port holes in the cabin walls the passengers have good vision to the sides and downward. Though these port holes are below the level of the lower wing, it is said that they provide ample light in the cabin without the ceiling floodlight. Near the ceiling on each side of the cabin is a shelf for storing clothing or small baggage. As the fuel tanks are some 15 ft. or so away from the cabin, there is little danger in smoking in the cabin. The cabin has seats for 16 people, 15 of which are for the passengers and the other for the steward. The steward's seat is at the rear of the cabin on the port side next to the galley. The galley is provided with buffet, oil stove, and ice box, so that light meals can be served in flight. On the starboard side opposite the galley is the lavatory, with running water.

The rear of the main cabin is entirely under the wings. Behind and connected by a hinged door is the luggage compartment. It has an entrance on the port side just behind the trailing edge of the lower wing. Steps are attached to the hatch to facilitate entrance or exit. This may also be used as an emergency exit for the cabin, in the event that the forward hatch is obstructed. The baggage compartment is exceptionally roomy and free from all bracing. In addition, the seats in the cabin are removable in the event that additional loads are to be carried. Behind the luggage compart-

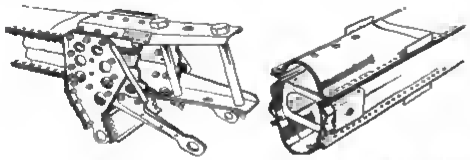
ment is eat walk on the floor of the hull so that one can walk back to the extreme tail. However, though this procedure might be desirable for inspection and repair purposes, it is not thought advisable in flight.

For transportation on land, a detachable land chassis is provided. It consists of two wheels, each mounted on one side of the hull. Each wheel is supported from the chine and the lower wing spar by four struts, two on the inner side of the wheel attached to the chine and two on the outer side attached to the forward and rear spars of the lower wing. They are secured by pins and are quickly detachable. In addition there is a permanent member between the chine and the spar fittings. This also acts as part of the wing trussing in flight. The detachable members are fitted with special bladders to prevent them from sinking when the undercarriage is being attached while the plane is afloat.

Each Wing Built in Three Sections

Each wing is built in three sections, two side panels and the center section. The upper and lower center sections, with the engines mounted between them, form a unit to which the outer panels are attached. The trusses of the engine mounts brace the center section. In addition there is the strut from the hull to the lower wing below each outboard engine. The outer interplane struts slope outwards because of the slight hangover of the upper wing. The upper and lower wings are the same chord and there is no stagger, the lower wing being directly below the upper. Both wings have a slight dihedral in the outer panel.

The internal wing structure is entirely of duralumin except for the bolts and some fittings which are of stainless steel. The spars, a Short Bros. development, are of box section, being built up of riveted, pressed, duralumin sheet. Top and bottom pieces are semi-circular in section with flanges at the edges. The side members, or webs, have two complete corrugations in them and are riveted to the top and bottom pieces along the flanges. This flange is also the point of attachment for the ribs. The sheets making up the box spars



Left, a section of the rear spar of the top center section. Right, a section of the top rear spar. Note laminations which reinforce the spar at point of attachment of fittings. (Courtesy of FLIGHT)

are laminated where the stress requires, as at the fittings and other critical points. However, the external dimensions are kept the same and only the number of thicknesses of metal is varied. These spars are said to be produced with remarkable ease using simple equipment, and have proved under test to be exceptionally strong for their weight. The ribs are built of seamless duralumin tubes riveted into the form of a Warren truss. Tubes bent to conform with the profile of the wing are used for the cap strips. Attached to these are the cross members fastened with light duralumin clips, using a single rivet in each cross member and two in the cap strip. The nose of the rib is a flanged duralumin sheet, blanked out with a flanged lightning hole. Compression members are of duralumin tubing built up of two sheets riveted together at diametrically opposite seams. Two fuel tanks, of tinned steel with a total capacity of 490 gal., are built into the center

Action picture of the Short Calcutta in the air

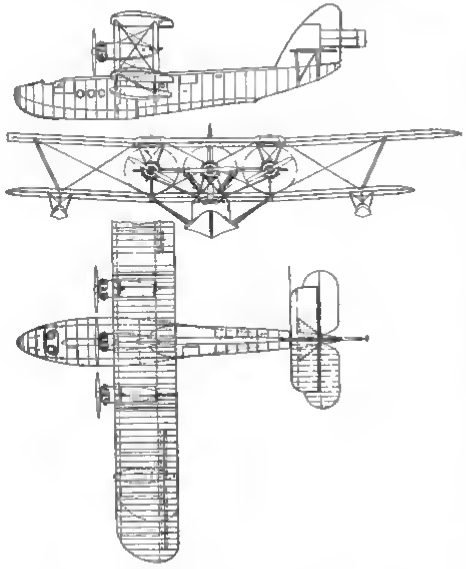
section of the upper wing. The tanks approach an airfoil in section and project slightly above the upper surface of the wing. They are supported by horizontal pins riveted to fittings on the front and back of the tanks. These pins are set in fittings padded with rubber and resting on the upper side of the wing spars. The wing covering is fabric except for the greater portion of the lower center section, which is covered with duralumin to provide a footing for the crew while working on the engines. A walkway is provided along the lower wing to the wing tips.

The outer interplane struts of the center section resemble the letter "Y" when viewed from the front and the middle strut resembles the letter "Y" inverted. The two upper members of the outer interplane struts straddle the gasoline tank supports, while the two lower members of the middle strut straddle the hull and are connected to the forward spar of the lower wing. An additional member connects the lower end of this strut to the mid-point of the outer struts. Except where size does not permit, all of these members are of duralumin including the fairing. The center section trussing forms a very rigid structure and, besides supporting the wings, acts as the mounting for the engines.

The three Jupiter engines are each mounted to the center section struts in streamline nacelles, similar in construction to the hull. The nacelles have no longitudinal members but depend upon the skin covering and transverse frames for bracing. All of the nacelles are identical and are almost perfect streamline forms, with only the cylinder heads and oil cooler projecting. Oil tanks, with a combined capacity of 45 gal., are carried in each nacelle behind the engine. The illustrations show the engines with open exhausts, but it is understood that collector rings, shaped to fair in with the nacelles will be fitted later. Gasoline is fed to the engine from the tanks in the upper center section. The installation

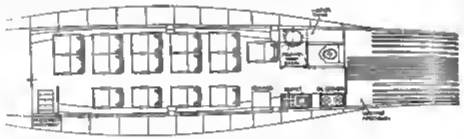
is such that the fuel can be directed from either tank to any of the engines. In the center nacelle from where it can start all three engines, is a Bristol engine starter. It can also drive a mechanically operated bilge pump or an electric generator for lighting or radio when the main engines are not running. The engines are all Bristol Jupiters developing 485 hp at 2,000 r.p.m. They are of series IX, with a compression ratio of 5.3 to 1. Two to one Farman type reduction gears are used and, because of the slow propeller speed, necessitate a four-bladed propeller to obtain sufficient clearances. The propellers are of wood, with the tips of the blades sheathed in metal to prevent damage by spray. They are formed of two two-bladed propellers to facilitate handling and transportation. For the removal of the engines without external assistance provision is made for mounting a special crane on the upper side of the nacelles and on the upper wing. These cranes have proved so handy that they are used in the Short Bros. factory as the easiest means of installing the engines.

All controls are carried through concealed channels fitted with inspection covers. Those for the empennage are carried



Three view drawing of the Short Calcutta. (Courtesy of FLIGHT.)

along the top of the hull and wherever practical, rod controls are used. The ailerons are of the Bristol-Frise type and are fitted to the upper wing only. They are rectangular in plan and are attached by four hinges. The tail surfaces, like the ailerons, are similar in structure to the wings, using duralumin box spars and duralumin truss ribs. The stabilizer is of monoplane design, externally braced by struts from the hull. Its setting can be adjusted from the cockpit to compensate for changes in balance while in flight. Only a single fin and rudder are used in spite of the fact that there are three engines. The fin has no external bracing except that afforded by the stabilizer which is mounted half way up the fin. The fin is built in two pieces to facilitate removal of the stabilizer. The rudder, like the elevator, is of the balanced type. To reduce the load on the rudder bar it is fitted with a servo-rudder. The servo-rudder, believed to be the invention of Anton Flettner, inventor of the Flettner rotor, consists of an auxiliary rudder mounted a short distance behind the main rudder. The pilot actuates the servo-rudder, which in turn actuates the main rudder. The servo-rudder is connected so that the controlling action, which turns the main rudder to one side, actuates the servo-rudder in the opposite direction. The resulting air load on the servo-rudder therfore helps to turn the main rudder in the desired direction. This type of control is becoming quite popular on large European planes, as it enables the pilot to work with ease on a very large area.



Plan of passenger accommodations in the Short Calcutta. (Courtesy of FLIGHT.)

The specifications of the Short Calcutta are as follows:

Length, overall, including servo-rudder	64 ft. 9 in.
Span, upper wing	93 ft.
Span, lower wing	76 ft. 6 in.
Chord, both wings	11 ft. 6 in.
Total wing area (including ailerons)	1,825 sq. ft.
Area of ailerons (total)	150 sq. ft.
Area of fin	56 sq. ft.
Area of main rudder	49 sq. ft.
Area of servo-rudder	7.6 sq. ft.
Area of stabilizer	112 sq. ft.
Area of elevators	105 sq. ft.
Weight empty	12,600 lb.
Disposable load:	
Crew of 3, with baggage, food and water	708 lb.
320 gal. gasoline and 30 gal. oil	2,730 lb.
Wireless, electrical equipment, instruments, fire extinguishers, cooking and marine equipment	562 lb.
Pay load (15 passengers, allowing 236 lb each)	3,540 lb.
Total disposable load	7,600 lb.
Weight fully loaded	20,200 lb.
Wing loading	11.05 lb. per sq. ft.
Power loading (rated power)	13.9 lb. per sq. ft.
Power loading (full power)	12.8 lb. per sq. ft.
High speed (sea level)	120 m.p.h.
Cruising speed	100 m.p.h.
Landing speed	57.5 m.p.h.
Climb (sea level)	800 f.p.m.
Service ceiling	10,000 ft.
Normal range (320 gal.)	5½ hr. or 500 m.
Range with full tanks (480 gal. gasoline and 45 gal. oil)	8·2 hr. or 740 mi.

A flying boat such as this, if put into private service, might be compared to a flying yacht. The interior could be fitted with banks for half a dozen people or more, who could live aboard for long periods. There is plenty of room aboard; the plane can carry heavy loads and it is known to be seaworthy. Sir Alan Cobham and Lady Cobham are now en route on a tour around Africa in a similar plane, the Short "Singapore." The twin engine Short Singapore type of flying boat has been in service with the Royal Air Force for some time.

The Problem of Combating Ice Accumulation

Continued from page 975

surface in a wind from some northerly quarter the thermometer reads about 25° F. and the humidity is moderately high. Up to the cloud-sheet's base at about 2,000 ft. the temperature falls steadily to about 18°, the humidity correspondingly rises, and the wind veers into an east or southeast source. At the cloud base a rapid rise in temperature, a saturated condition of moisture and a drift of air from south are to be found, and within this cloud base temperatures may be considerably above the freezing point. Such clouds are 2000-4000 ft., and within them a second temperature fall with increasing altitude sets in. As a result, it sometimes happens that in this rain-making factory rain is turned out in the lower reaches while snow is produced higher up which in falling through the warmer layers is melted to a liquid or perhaps colloid state.

The rain-factory marks the turbulent and intermixing air which is sandwiched between a heavy cold stream below and a light warm mass above. This condition persists as long as each current can be maintained and vanishes when either is occluded. It is in falling through this lower reach of subfreezing atmosphere that the raindrops attain to temperatures similarly low, and when they break against any object are promptly congealed. Sometimes they are congealed in mid-air and the result is these frozen pellets of ice which are termed sleet. When an airplane flies through air containing sub-cooled raindrops, its surfaces in smashing the surface tension of these drops provides the trigger action to set off immediate crystallization upon the plane, with the result that a coating of ice immediately builds into the wind from all leading edges on the plane.

In addition to the danger of taking ice when falling rain is found freezing on the ground surfaces there is some danger when the rainfall is occurring with surface temperatures between 32° F. and 40° F. if the plane is taken up over altitudes of 2,000 to 4,000 ft. above ground. Ice can then be taken as a result of the temperature lapse with altitude which is about three degrees F. for each thousand feet under such conditions.

The structure of the air which has just been described as existent during the fall of freezing-rain (sometimes called glaze) is slightly modified in the condition technically called a sleet-storm. Sleet is a precipitation of ice-pellets, which are really congealed raindrops frozen completely as they have fallen through the cold substrate of the atmosphere. It is likely that sleet results when a generally colder state of affairs exists aloft than is found when subcooled rain falls; quite possibly it is safe to assert that at the upper levels, sleet originally may have been snow-crystals, then melted to a mixture of slush and water in active condensation, and while in this state frozen into pellets of sleet, all this series of change occurring as the condensed particles fell through the air.

Sleet if completely frozen is not capable of sticking to the planes. Flights through sleet unattended by rain can be safely made, although the pellets may attack fabric or wood surfaces. The caution which should be emphasized as necessary in the sleetstorm is to the effect that the pilot must beware of taking his plane into a zone where rain mixed with the sleet will introduce the ice-hazard. Or he may be compelled by hills to climb to an altitude which will force him into the cloud-ceiling. Here freezing clouds will make ice barnacles at a dangerous rate. This will be described later.

A flight through a sleet-storm was made by pilots in a Liberty engined Fokker biplane from Hadley Airport to Bolling Field, Washington, Dec. 4, 1927. The factors involved in this instance were weighed carefully and the weather conditions likely to be met were discussed with the writer with a view to getting the plane through if this could be considered at all feasible and safe. At Hadley sleet (without any trace of rain) was falling steadily from a 3000 ft. ceiling, visibility five miles, surface wind NE—26 m.p.h. becoming 40 to 50 m.p.h. at 3000 ft. and temperature 24° F. At Washington the conditions were almost precisely the same, the ceiling being slightly lower and the temperature 26° F.

The flight seemed feasible because the strong tailwind would send them southwestward at a fast rate sufficient to make them cross over a landing field every ten minutes, and they

AIRWAYS WEATHER REPORT

December [illegible], 1927

Altitude	Place	Hour	Weather	Ceiling	Visibility	Wind	Temp. °F.
150	Hadley	Noon	O'cast	3000	15	[illegible]	34
		8 p.	Broken Clouds	6000	15	[illegible]	34
1080	York Place, Pa.	9 p.	Light O'cast	2500	20	[illegible]	[illegible]
800	Tamaqua, Pa.	11 a.	O'cast	1800	[illegible]	W-15	34
1130	[illegible], Pa.	9 p.	O'cast	2000	[illegible]	[illegible]	[illegible]
2000	[illegible] Mt., Pa.	8 p.	O'cast	600	15	[illegible]	[illegible]
1000	Bellefonte, Pa.	11 a.	O'cast Frozen Mist	1000	[illegible]	W-10	34
		8 p.	O'cast	1700	V	[illegible]	34
1618	Snowshoe, Pa.	9 p.	O'cast-Lt.8000	600	6	[illegible]	[illegible]
1960	[illegible], Pa.	9 p.	Foggy Rain & Sleet	0	[illegible]	[illegible]	[illegible]
1415	Du Bois, Pa.	11 a.	O'cast [illegible] & 3000	600	[illegible]	W-14	[illegible]
1880	Clarion, Pa.	8 p.	O'cast Snowing	600	6	W-12	34
780	Cleveland, O.	Noon	O'cast Snowing	800	3/4	[illegible]	33
		9 p.	O'cast	800	14	[illegible]	32

Fig. 8

were cautioned not to attempt to reach up too close to the ceiling and to be prepared to descend in case the sleet should turn to rain, an eventuality that is difficult to exactly foretell. A course inland was safer than over the water. The storm center was off the Carolinas' coasts moving northeastward, and if the flight was much delayed would have allowed it to move so near Washington that the warmer and moister regions of the storm would close down on the course. This rare instance of all elements being favorable for flight was a notable success and the flight lasted 80 minutes only, at which time they descended to the surprise of Bolling Field and reported that once near Baltimore ice began to form on the windshields, but was a local and transient condition soon left behind. This flight emphasizes the need for full, completely accurate and well-studied meteorological advice before attempting flight. Its rarity is the exception to the rule that sleet and ice are too dangerous for flights of any length of time or distance.

Besides occurring as falling drops of water (rain) the subcooled moisture may remain in suspension aloft as cloud or fog. Because of its stealthy onset, its occurrence throughout a big range of sub-freezing temperatures, and the restrictions which such a cloud ceiling may set upon altitude to which a plane may ascend, this type of ice-barnacle challenges designers, pilots and weathermen alike. No dependable device to rid the plane of ice has been found, nor one to prevent its attachment, no designer has a creditable record for making planes invulnerable to ice, and we still lack an entirely proven explanation of the physical processes involved.

About these processes several features are so unmistakably prominent that when taken up in connection with the theories which best fit the facts they may be said to represent the

true as we know them in the present imperfect state of our knowledge. It has been our privilege to hear numerous details recounted by the pilots who have flown in and out of this airport during the past two winters; we have to bear in mind however that the pilots have such demands upon their attention at the onset of this ice that they may well be excused if their reports do not contain all that we would like to know. To continue investigations of the nature of the processes involved in this most harassing danger of the free-air, it is hoped that the Weather Bureau may be able to have recording instruments synchronized to record on a graph the temperature, humidity, and altimeter readings of instruments mounted on the wings of the planes.

One of the proven facts is that clouds composed of ice crystals or snow yield no ice to the planes. These clouds are however comparatively rare at ordinary altitudes and the best example of such a cloud is the mare's tail cirrus fibers which float at great altitudes. Another kind of cirrus cloud covers the sky with a greyish pall and causes rings (halos) around sun and moon. But these snowdust clouds are not frequently found at flying altitudes. All other clouds seem capable of making ice when their temperatures are below the freezing point of water, and as a result of optical phenomena often observed, the meteorologist understands them to be composed of minute spheres of water. These wet clouds run the whole gamut from the thick, high masses of water vapor just on the verge of rain to the thin shapeless masses of haze and vapor which have hardly become cloud, and throughout this range they are potential ice makers. In fog (cloud on the ground) temperatures as low as 21° below zero F. have been trustworthily observed and the vapor particles found to be tiny water droplets.

While the mysteries of the subcooled but unfrozen water droplets await final detection, some fairly acceptable theories may be put forward. In changing from the vapor to the solid state many kinds of matter take on intermediate liquid form. In those substances which crystalize, such as water, it seems that this crystal making force is suspended awaiting the trigger-like set-off of some obscure catalysis, which once introduced permits rapid extension of the crystal action. Subcooled water globules may perhaps be imprisoned within a shell surface tension or electrical charges which must be broken before the perfect equilibrium of the forces is shattered and ice results. In the free air, perhaps this shattering is quite uncommon, except in the turbulence of storms. Snow has been explained as developing from these minute water spheres by a process which assumes that crystallization occurs on certain spheres, resulting in minute hexagonal plates which in contact with other water droplets attach these to themselves and grow into the beautiful forms which we find in falling snowflakes. Microscopic studies of snowflake details show evidence of imprisoned water within the structure of them and such flakes may have grown very fast.

And while this water vapor cooled far below the freezing point and saturating the space where we detect clouds may resist crystal action when unmolested, once smashed by the impact of the various parts of an airplane, ice forms forthwith with an appalling alacrity. As the droplets impinge on the leading edges they build forward into the wind "heads" of ice which may so alter the shape and cross section of members of the plane's structure as to be responsible for the flight-curtailing results so often felt. It has been deemed safe to assume that the temperature of the plane's parts can be but little different from the air in which the vapor exists. Once begun the process seems to proceed with added rapidity.

To take ice rapidly it is assumed that the air must be saturated with water where the plane is flying. The temperature of this air must be below 32° F., and perhaps down as low as 10° or 15° F. In the vicinity of zero and thence lower the amount of vapor which can remain in the air when saturated becomes so small that even under these conditions of saturation the amount of ice collected in a short time becomes so small as to constitute little danger, because before they overwhelm him the pilot can escape to more favorable locations. As a rule the lower the temperature the more frostlike and white is the deposit of ice; near 32° F., occasions have been reported of a nearly transparent coating being taken, assuming when becoming heavy a ripple-like surface in appearance

Section of a Bureau of Agriculture weather map

much like the wind whipped sand-ripples frequently observed on beaches. Such roughened or wavy coatings aggravate the tendency already developing for the ice to increase head-resistance and decrease the suction side of the lift of the wings if not promptly evaded or cleared it is likely to prove disastrous to any type of plane now in regular flight-work.

Once a plane has become iced-up, two alternatives for clearing away the accumulations of glazing may be available as a result of properties of the air itself at some certain level. One is to climb sufficiently to come clear above the clouds. Here the ice will disappear by rapid evaporation to the comparatively dry air clearly shown by the absence of cloud, if very dry then the ice literally vanishes as if melted away although the action is entirely one of evaporation directly from the ice into vapor (known as sublimation). This method of shedding ice is certain and puts the airman where he will take no more, but it is not usually as practicable as desirable. For one reason the plane which is feeling the effects of ice must climb fast through the clouds at a time when it is becoming increasingly difficult to maintain even a constant altitude; for another the feat may almost be accomplished but fails and then the craft stands in danger of getting a dangerous icing on the way down through the clouds. Breaks in the cloud sheets sometimes can be taken advantage of.

The other alternative for shedding the ice also has drawbacks. It consists of "hedge-hopping" at the lowest levels possible, thereby keeping out of the clouds and also at the same time making the most of any temperature increase which usually takes place with decreased altitude. The action here is usually both that of evaporation and melting. It h

feasible when the cloud does not rest on the ground as fog and when the terrain is fairly level. In crossing ridges, an airman must know his route well to keep from "piling up."

In Fig 2, the daily Weather Chart for 8 A.M. Dec. 20, 1927, weather conditions which were attended by icing up on the Cleveland-New York airway are shown. The case is typical, and the attention of pilots may well be drawn to the fact that upon casual examination this may look like a fair-weather map with west and northwest winds, and the weather reports from many city stations show cloudy or partly cloudy skies which usually mean satisfactory flying. These clouds may completely enshroud the higher ridges. They consist of masses of moisture released from the Great Lakes whose temperatures during the main part of winter are higher than those of surrounding regions and of the air which drifts down from interior Canada across them. Turbulence within this wind induced by both its rapid motion and the rising ground of inland Ohio and Pennsylvania (Fig. 3), soon stirs this moisture up to be chilled into clouds whose baleful and insidious ice-tentacles are ready to grasp our finest air craft.

The problem of ice-barnacle action will have to be solved before regular transport lines in many regions can be said to be even partly independent of the weather. The problem challenges the best engineers. Thus far, the application of various soluble, saponaceous, and oily substances to the wings

Uncoated	Coated to assume 1/8 in. on (1), (4) and (5) and 3/8 in. on (2), (3)
(1) 1.347 lb.	37.22 lb. (ratio 1/30)
(2) 14.906	197.40 (ratio 1/13)
(3) 8.449	176.10 (ratio 1/20)
(4) 1.557	20.10 (ratio 1/13)
(5) 1.756	22.25 (ratio 1/13)
Tot. 28.18	443.97 (ratio 1/16)

Fig. 4. Table showing approximate resistance developed by 1-mm and wa-inch wires. Figures based upon an airspeed of 100 m/hr. and resistance for streamlined wires, and for cylindrical hard seneth wires, for uncoated and coated conditions respectively.

(1) Stabilizer wires total length 19 ft., .078 in. thick
(2) Flying wires total length 110 ft., .152 in. thick
(3) Landing wires total length 80 ft., .090 in. thick
(4) Center section brace wires length 14 ft., .112 in. thick
(5) Incidence brace wires 10 ft., .112 in. thick

The ice-coat is neither hard nor smooth, and the figures for thickness of the ice coats are most conservative. The plane used in the calculation is the Air Mail Douglas Type M-4. (Courtesy of Pilot Thomas F. Nelson)

has helped for a brief time to prevent ice there but the action is short lived and too incomplete for safety. To eliminate struts, wires and all possible exposed surfaces, is to attack the problem in another way. Suggestions have also been advanced that metal planes can be heated to prevent ice, and this suggestion must be given careful consideration; it has the merit of being continuous in action and positive in results. It must however be developed on a scale commensurate with the great lavish expenditure of energy which we have to deal with when we search into the secrets of free air. In the meantime it will be of value for the pilot to think of this ice action in terms which in imperfect completeness have been already discussed, with the hope that any further data of interest be brought to the attention of those best suited to interpret and study them.

Materials of Construction

Continued from page 974

flexible, flexible, and extra-flexible. The latter two are used in control surfaces where pulleys and corners must be rounded past, the non-flexible cable is used for bracing. The particular advantage of these wires is that they are made of a number of strands and in cases of excessive strain some one strand will give way first thus giving a timely warning of impending failure.

The end connections of stranded cable are made in a similar manner to those of hard wire. The end of the cable is looped back on itself and then wrapped closely with copper wire and the whole joint dip soldered. Sometimes when the cable is looped back on itself the free end is spliced into the cable proper and then wrapped with strong cord and painted over with two coats of shellac. In either case a thimble is put inside the loop to prevent fraying of the strands. One end of this type of wire is always attached to a turnbuckle

Table 10.

Properties of Tie-Rods

Size and Threads per Inch	Streamline Breaking Strength	Round Breaking Strength	Square Breaking Strength
5-40	1000	1000	1000
10-32	2100	1900	1900
18-28		2600	2600
1/4-28	5400	5400	5400
5/16-24	8100	8700	8700
3/8-24	9200	8500	8500
7/16-20	11500	11500	11500
1/2-20	15500	15500	15500

which may be tightened to take up slackness in the cable. It is especially important that this turnbuckle be safety wired with copper wire so that vibration will not shake it loose.

The properties of stranded wire cable are given in Table 9. The non-flexible cable is made up of 19 strands of wire, the flexible cable is composed of seven small cables each of which contains seven strands of wire; the extra-flexible cable which is used in control systems whenever any sharp corners must be gotten round is composed of seven small cables each containing nineteen strands. It is generally true that the more rigid the wire, the stronger it is. Thus in Table 9 it may be seen that the order of strength is non-flexible, flexible, and extra-flexible.

As mentioned above there are streamline, round and square section tie-rods used on airplanes to take tension loads. The streamline rods are used externally and the others for internal trusses. The strength properties for these rods are listed in Table 10.

The end connections for tie-rods are simpler and more positive than any of the connections for wire or cable. With wire or cable it is very difficult to get a loop that will not elongate or a joint that will not slip under load. In the case of tie-rods the ends are somewhat thicker than the rest of the rod and are threaded. A rigid forked terminal screws on and is locked by a lock nut. Each end of the rod is exactly the same. This forked terminal passes over a lug which is part of the fitting and the two are held together by a clevis pin. The forked terminal is itself what is commonly known as a clevis. Tie-rods may be ordered complete from several companies by merely quoting the size or strength desired. The proper clevis, lock nut, and pin will be sent attached to the

rod. It is then up to the manufacturer to fashion the right size lug on his fitting to take the desired load.

The Department of Commerce is particularly insistent that the lugs be made as strong as the rods and clevises to which they are attached. Quoting from Paragraph 4 under Miscellaneous Requirements in the Handbook

"The dimensions of all lugs should be such that they will fit standard clevises of corresponding sizes. The average strength of lugs of any design shall be at least 15 per cent. in excess of the rated strength, and the actual strength of any individual lug must not be below the rated strength. Lugs made of cold-rolled steel, in conformity to the limiting dimensions given in Fig 47 are considered to comply with the above requirements. Lug designs of other materials, or not in conformity with the dimensions of Fig. 47 will have to be tested before acceptance. Such tests must be carried to destruction of the lug and the type of failure reported.

"The following rules govern the use of Fig. 47

"1. Dimensions T and D are determined by the dimensions of the fork ends of the standard terminals and the area required for bearing of the pin

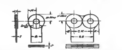
"2. Dimension K is determined by the required strength and the fork and dimensions. It shall be neither exceeded nor diminished, except to the extent of the manufacturing tolerances.

"3. Dimension M is a minimum which may be exceeded if desired.

"4. Dimension B is the least width of shank allowable with the given plate thickness, t, and may be exceeded if desired.

"5. When pin plates are used, care must be taken that the stress imposed on the pin plates by the pin can be carried into the shank of the lug"

These requirements are self-explanatory and Fig. 47 is given in such detail that acceptable lugs can be designed with a



No.	Rated Strength	B	K	M	C	T	Width of Shank B								
							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	1,100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					
21	2,100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
34	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
46	4,600	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
61	6,100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
80	8,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	1	[illegible]		
125	12,500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
175	17,500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Fig 47

minimum of effort. The rated strength of the wire to be used as read from Tables 9 or 10 will indicate the lug to be designed from Fig 47.

Rivets are often used to fasten two tubes together such as torsion tubes, to fasten fittings in place, and to join metal sheets. In the use of duralumin where the process of welding has met with but little success all joints must be riveted. In the newest type of wing beam construction, that of all metal flanges with trussed web, rivets are used extensively. The strength properties of rivets both dural and steel are listed in Table 11

The values given in the Table are for single shear. When the rivet is in double shear the allowable strength given in Table 11 may be doubled. Fig. 48 is an illustration of a rivet in single shear and in double shear. Whenever possible a rivet should be put in double shear as this not only doubles its strength in shear but imposes a concentric load on the lug. It prevents any tendency to twist and tear off the head of the rivet.

Dural rivets should always be driven within half an hour after heat-treatment while they are still plastic. After that

Table 11.
Shearing Strength of Rivets, Bolts or Pins.

Size of Rivets, Bolts or Pins	Strength in Single Shear — Allowable Shear: 30,000 lb/sq. in.* Dural	35,000 lb/sq. in. 55,000**	75,000 lb/sq. in. 125,000***
1/16	88	109	232
3/32	207	242	518
.112	294	343	735
1/8	368	431	910
.138	447	522	1117
5/32	575	672	1440
.154	635	730	1580
3/16	828	955	2000
.190	848	991	2120
7/32	1128	1316	2820
.216	1101	1285	2750
1/4	1473	1718	3570
5/16	2301	2685	5630
3/8	3315	3868	8110
.4375	4509	5261	11100
1/2	5858	6871	14440
5/8	9204	10738	23000
3/4	13254	15463	33130
7/8	15038	21045	45100
1	23562	27489	58800

* For duralumin bolts, pins and rivets.
** For mild carbon (1025) steel.
*** For nickel steel (2330).

period of time they become too brittle and the heads crack easily and corrosion sets in. A good broad head is advisable especially where the sheet being joined is very thin otherwise the head may tear through the sheet. When more than one row of rivets is necessary each succeeding row should be staggered. It is especially important that the first row should not be too near the edge of the sheet.

Sheets riveted together should be just as strong in bearing as the rivets are in shear. Table 12 gives the strength of steel sheet in bearing against different size rivets; Table 13 is a similar chart for duralumin sheet in bearing against rivets.

The process of welding steel consists in heating the joint ends to a white heat (2200 deg. F.) and while at this temperature fusing the metal of the welding wire with the metal of the joint ends until the joint is filled. This requires extreme care and skill as the temperature must be judged by the color of the metal. Table 14 is a list of the temperatures and corresponding colors of steel. The melting point of steel is 2500 deg. F. and the welder is working near this point all the time. Every degree of heat over 1600 deg. F. is injurious to the steel, and every second this heat is applied burns out the carbon (indicated by sparks).

Table 14
Temperature and Corresponding Color of Steel

Degrees Fahrenheit	Color
430	Very pale yellow
460	Straw yellow
480	Dark yellow
500	Brown yellow
530	Light purple
550	Dark purple
570	Dark blue
750	Red, visible in dark
1050	Blood red
1175	Dark cherry
1250	Medium cherry
1375	Cherry or full red

1550 .... Bright red
1650 .... Salmon
1725 .... Orange
1825 .... Lemon
1975 .... Light yellow
2200 .... White

The fused metal of a joint is of a cast structure and does not have the physical properties or strength of the original metal. The strength of the material from ¼ to ¾ in from the joint is also decreased. The Department of Commerce demands that the efficiency of a welded joint in unheat-treated steel should be taken as 80 per cent. A welded joint made after steel is heat-treated reduces the strength properties to those for the unheat-treated material. Wires and cables should never be welded as heat will destroy their strength almost entirely.

The welding and repairing of tubular structures can be performed successfully providing the following precautions are observed:

1) No splices shall be made in structural members (i.e. longerons, spars, interplane struts, and landing struts) by butt welds subject to direct tension or bending stresses, unless the joint is reinforced by riveting, pinning, telescoping or other auxiliary means.

2) Welded joints shall not be cleaned up by filing, as such treatment causes a loss of joint efficiency

3) The parts to be welded shall always be cleaned by sand papering or brushing with a wire brush

4) For splicing tubes "fishtail" welded joints should be used The angle between the weld and the axis of the tube should not be more than 30 degrees.

5) All splicing should be done as close to the strut point as possible, as a tubular member is under greatest stress in the middle and the full strength in that portion of the tube should be retained

The term brazing is defined as a method of joining steel parts by means of dipping them in a molten copper zinc mixture. The strength of the brazed joint depends upon the surface area of the joint and the clearance between parts. This clearance should be as small as possible The allowable strength for a brazed joint is 10,000 lb per sq in of joint area that is subject to brazing

Soldering is defined as the application of a tin-base or silver-base metal to two surfaces to form a joint. This type of joint may not be used in the primary structure of an airplane as small applied loads and vibration will soon cause failure of a soldered joint Soldering is often used on gas tanks. Where parts are subject to vibration or temperatures exceeding 150 deg F. and it is not desirable to use brazing, silver solder should be used. No parts should be welded that have already been soldered or brazed.

Duralumin is an alloy of aluminum which is about as strong as mild carbon steel but weighs only one third as much This tremendous advantage in weight however is nullified somewhat by the fact that duralumin cannot be welded or brazed, and because the modulus of elasticity of duralumin is but slightly more than one-third that of steel. Thus for long columns i.e. those that fall within the Euler formula, there is but a very slight weight advantage and the difficulty of end connections is present. However in the constant attempt that is going on to decrease the structural weight of

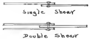


Fig 48.

airplanes to a minimum duralumin is finding its place and is daily becoming more popular as manufacturers become familiar with its working

The physical properties of duralumin are:

Weight per cubic foot	pounds	175
Ultimate tensile strength	lb. per sq. in.	55,000
Yield point	" " " "	30,000
Ultimate shearing strength of rivets	" " " "	30,000
Ultimate bearing strength	" " " "	75,000
Modulus of elasticity	" " " "	10,000,000

To realize these properties duralumin must be heat-treated. It must also be worked within two hours after heat-treatment else it will become so brittle that working is quite impossible. If operations must be performed on it that will take longer than two hours the material should be annealed and then the finished product heat-treated.

Duralumin corrodes easily in the presence of moisture and must be coated with grease, bitumastic, or an oxide (anodic treatment) to prevent it from corroding rapidly Bitumastic is a coal tar product that adheres to the surface of the duralumin and prevents moisture from coming in contact with it Grease acts in the same manner if the surface is kept well covered The anodic treatment of duralumin requires an electric bath in which the metal must be submerged for a definite period of time and the current passing through be kept within limits This treatment causes a coat of aluminum oxide to form on the surface which is a very good protection. Thus far this has proven to be the most successful means of protecting duralumin from corrosion

Columns of duralumin are classified as long or short columns depending upon their slenderness ratio Table 3 of Chapter 5 gives the critical length of duralumin tubing of various diameters that determines whether they are long or short columns.

Tubes of greater length than those given in Table 3 are long columns that are designed by the Euler formula. The formula is

Size of Rivets	1/16	3/32	1/8	5/32	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
Plate Sizes	Bearing Strength of Plate												
.022	133	243	332	413	423	333	331	397	1330	1333	1003	2223	2646
.032	203	312	413	330	323	831	1030	1247	1333	2078	3434	2930	3313
.049	291	433	432	727	373	1164	1433	1743	2328	2900	3431	4373	4046
.058	344	317	339	331	1062	1373	1722	2333	2733	3444	4133	4331	5514
.065	383	373	772	935	1143	1344	1333	2313	2333	3330	4331	3433	3173
.072	423	341	365	1033	1383	1713	2133	3465	3423	4276	5100	3930	4640
.083	408	733	333	1233	1478	1871	2464	2097	3343	4320	3314	3300	7566
.095	364	840	1133	1413	1202	2333	2820	3384	4313	3341	2743	7307	0625
.120	713	1233	1423	1781	2133	2330	3323	4273	3730	7133	3423	0373	11400
3/16	1113	1873	2327	2793	3343	4433	5533	3383	2033	11133	13343	13333	17313
1/4	1484	2287	2930	3711	4443	3033	7422	3333	11873	14844	17813	20791	23780

Table 12. Bearing strength of steel sheets on rivets. Allowable bearing—95,000 lb./sq. in. For use with A.S Spec. 10,201 sheet.

$P = c\pi^2EI/L^2$ where E = 10,000,000 for duralumin.

Fig. 42 of Chapter 5 is a direct reading chart for steel tubes as long columns. These are designed by the same formula as the duralumin tubes but for mild carbon steel E = 28,000,000 and for chrome-molybdenum steel E = 29,000,000; thus since their E is almost three times as great as the E for duralumin the values read from the chart will be almost three times as great as the allowable P for duralumin. However if we use the scale of Fig. 42 marked E = 29,000,000 and divide the load P obtained by 3 the answer will be only 2 per cent. off and this will be on the safe side. Therefore Fig. 42 may be utilized to design duralumin columns as well as steel. It must be borne in mind that this chart is figured for a coefficient of restraint of unity but as most duralumin columns are figured on that basis it will cause no complications. If the ends of a duralumin column are heavily gussetted and riveted a restraint coefficient of 1.5 is allowable. In this case the allowable load may be figured for a coefficient of unity and the result increased 50 per cent. to give the allowable load for a long column with a value of C = 1.5

Tubes of shorter length than those given in Table 3 are short columns and should be designed by the so-called straight line formula. This formula agrees most nearly with a large number of actual tests made on duralumin tubing ranging from ¾ to 2¼ inch diameter. This formula is

$$P = 48{,}000A - 400LA/\rho\sqrt{c}$$

in which A is the area of a cross-section of the tube and may be obtained from Table 5 of Chapter 5

L is the length of the tube

ρ is the radius of gyration of the tube and equals $\sqrt{I/A}$. The value of I may be obtained from Table 4 and ρ figured.

c is the value of the restraint coefficient.

Fig. 49 is a nomographic chart for duralumin tubes as short columns based on the straight line formula. The full lines are for a restraint coefficient of one and the dotted lines for a coefficient of two. For values in between the formula explained just above must be used. The allowable load for a short column does not vary directly as the coefficient of restraint as is the case with long columns and therefore the allowable load for a coefficient of unity cannot be increased proportionately as the restraint coefficient. This is unfortunate but with some little practice the formula can be used and tubes designed quite rapidly. The table in the lower right hand corner of Fig. 49 gives the maximum load that tubes of various gauges and diameters can stand. This table must be consulted carefully if a tube whose length is less than 15 inches is being designed. If the monogram is used as it stands values can be read off for extremely short tubes that are greater than the tube can stand. And so for tubes of 15 inches or less in length a watch must be kept on the table to see that the value obtained from the nomogram is not too great. The lower value of the two is the one to be used.

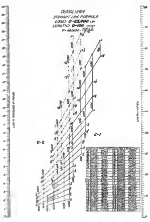


Fig. 49. Nomographic chart for duralumin tubes as short columns—straight line formula.

The modulus of rupture and ultimate tensile strength of duralumin is 55,000 lb. per sq. in. For pure bending and for combined bending and tension the allowable stress is then 55,000. This figure applies only to solid sections. As with wood nearly all duralumin beams have a form factor. Sufficient experimental work has not been done to assign a definite form factor to each section but the allowable stresses

Size Rivet or Pin	1/16	3/32	1/8	5/32	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1"
Plate Thickness	Bearing Strength of Plate												
*.014	28	55	65	86	78	162	131	153	216	365	313	268	426
*.022	54	88	137	184	181	214	655	351	455	838	543	780	867
*.028	165	165	215	555	316	465	555	435	845	1556	1266	1475	1889
.032	154	342	283	415	432	534	828	634	1512	1645	1568	2266	2674
.042	180	381	375	465	583	766	866	1158	1555	1876	2255	2628	2880
.049	555	345	465	573	390	826	1166	1677	1838	2295	2784	3312	3672
.058	678	488	644	680	513	1653	1866	1521	2174	2713	3261	3805	4248
.065	553	487	616	766	514	1616	1504	1827	2486	3048	3634	4262	4852
.083	688	584	778	876	1165	1887	1646	2534	3116	3886	4668	5442	5524
.095	445	886	881	1114	1355	1788	2257	2676	3525	4462	5348	6386	7120
.120	883	844	1153	1407	1688	2258	2818	3670	4555	5555	5755	7675	9050
5/32	782	1555	1464	1835	2136	3005	3555	4055	5585	7626	8765	10256	11720
3/16	875	1310	1755	2158	2387	3516	4335	5874	7555	8786	10548	10608	14064
1/4	1178	1758	2344	2860	2616	4035	5360	7655	9585	11735	14075	16416	18760

* In figuring bearing stresses for sheets under 0.035".

Table 13. Bearing strength of duralumin sheet on rivets. Allowable bearing—75,000 lb./sq. in.

have been cut down. A value for the modulus of rupture of 45,000 lb. per sq. in. is the maximum allowable. This value may be applied only to particularly well-designed sections. For ordinary sections a value of 40,000 lb. per sq. in. is advisable.

For combined bending and compression the allowable stress is somewhat less than 45,000. The formula is

$$F_c = f_b/f_c(45{,}000 - 36{,}000) + 36{,}000.$$

f_b/f_c is the ratio of bending stress to combined bending and compression stress. It can readily be seen that if the stress were pure bending without compression this value would be unity and F_c would equal 45,000 lb. per sq. in. When a large part of the stress is due to compression a value of F_c very near to 36,000 lb. is all that is allowable.

In Fig. 45 of Chapter 5 a curve for the allowable stress of duralumin tubing in torsion is drawn. The required stress in torsion or in combined torsion and bending may be determined in the same manner as for steel tubing. These formulas are explained in great detail in Chapter 5.

Table 7 of Chapter 5 lists the tensile strength of commonly used duralumin tubes. These strengths are listed under the column heading 55,000. It is to be noted that duralumin and mild carbon steel each have an ultimate tensile strength of 55,000 lb. per sq. in. and are therefore equally strong in tension. Duralumin however weighs only about one-third as much as the equivalent steel tube. Comparison of the third and fourth columns of Chapter 7 will illustrate this point.

We have discussed in turn wood, steel, and duralumin as they relate to structural members of aircraft. All three have advantages which adapt them more nearly to a given purpose than either of the other two. The designer then must study each location on his plane and decide which material is most adaptable in each case. Of course it is preferable to use all but one material if possible from the view point of simplicity, but yet if weight is to be saved and durability assured a more complicated structure must be designed.

The chief advantages of wood are its great strength for a given weight especially when used in bending, its cheapness, its adaptability for experimental work or for limited production jobs, the possibility of designing very closely without being restricted to standard sizes, and the comparatively unskilled labor that can be used in its working.

Its disadvantages are the great waste in securing satisfactory quality for airplane use, the rotting in service, the absorption of large weights of moisture, the inability to fasten it securely enough to take tension loads, and the inequality in strength and weight of pieces of the same lot.

Steel is of course extremely strong, durable and reliable. By using alloy steels or by heat-treatment almost any desired strength of steel can be obtained. If coated with a rust preventive it will last indefinitely. The properties of steel are very uniform. In addition, end connections can be made very readily with steel. In particular the welding of steel does away with the necessity of designing fittings which are very expensive and weigh a great deal. Then too, for a given strength, steel is very compact and may be used wherever space is limited. This also applies to external locations where a minimum of parasite resistance is desired.

The main disadvantage of steel is its weight. This is felt particularly in locations where it is desired to use very thin sheet steel. To avoid local crumbling a minimum gauge must be used which is often a great deal stronger than is really necessary. This adds undesired weight to the structure. Another disadvantage of steel is that when repairs are made in the field almost always a mild carbon steel member is used for replacement. It very often happens that the member replaced was chrome-molybdenum or alloy steel of great strength. Mild carbon steel being much weaker will destroy the safety of the entire plane. All steels look so much alike that it is quite difficult to tell one from another. Adequate marking and education of the repair man are the only solutions to this problem of replacement.

Duralumin has high strength combined with light weight. Its disadvantages however are the difficulty of making end connections, the necessity of heat-treatment to obtain its maximum strength, the need for a protective coating to prevent corrosion, and its expensiveness. When it comes into more general use its expense will be less and constant research is providing better protective coatings.

From the foregoing and other considerations it is thought advisable to use the various materials in the locations listed below.

1—Exposed struts should be streamlined steel tubes for fast planes and streamlined duralumin tubes for transport planes.

2—Engine mounts should be constructed of steel and the rest of the fuselage of duralumin.

3—Spars of small externally braced thin wings should be of spruce or simple duralumin sections, while deep, internally braced wings should have trussed metal spars.

4—Wing ribs should be of spruce or duralumin in all airplanes.

5—Propellers should be of metal—duralumin for large transport planes and steel for fast planes.

Continued in next week's issue

The Accessory and Equipment Division

Continued from page 973

The lenses are inclosed in a cylindrical glass housing with a hemispherical glass dome. The base is constructed of aluminum having three bronze pipe stand legs. The flashing is controlled by a drum type flasher which may be set to produce any desired coded signal with flashes of long duration.

The type PF-8 Triple Reflector Floodlight is constructed of sheet metal and brass castings and is provided with a 180 deg. 7 element, hand cut Fresnel lens. There are three reflectors made of chromium plated spun copper. A hemispherical reflector is placed behind the lamp. Two parabolic reflectors are fitted above and below the lens so that stray light which would otherwise be wasted is utilized in producing a wider beam. This unit uses a 1000 watt lamp and can take the place of a number of smaller lights with the ordinary metal reflectors.

The type AF-8 Floodlight unit is similar to the type PF-8 except that it is more compact and the parabolic reflectors are omitted. It is recommended for the illumination of the air markings of the city names on the roofs of buildings.

BERRY BROS.

Detroit, Mich.

This exhibit which covers 250 sq. ft. of floor space is featured by the showing of a three place commercial airplane completely finished in Linoil and Aircraft Berryload in a striking but harmonious color combination. The fuselage and tail surfaces are finished in Aircraft Berryloid, special napier green with gold striping and letters, while the spinner, disc wheels and wings are finished in Aircraft Berryloid, Waco maize. The struts and landing gear are in black. Supplementing this feature, there are a large number of model airplanes finished in a wide variety of attractive color combinations. There is also included in the exhibit a complete set of large steel door panels finished in all Berry Bros. standard combinations of Aircraft Berrylnid. A number of pan-

of fabric, plywood and various metals are being exhibited and all are finished in the company's new fabric finish known as Berryloid dope colors This material represents the very latest development in fabric finishes. An expert aircraft finisher is serving at the Berry Bros. exhibit during the entire show to give authoritative advice regarding the best methods for finishing aircraft. An ample supply of literature setting forth the very best thought in aircraft finishing is being distributed at the Berry Bros. booth.

T. B Colby, manager of the Marine and Aviation Dept., is in charge of the exhibit. J. E. Berry, H H Longaker and A. L. Clark are assisting Mr. Colby

BECK DISTRIBUTING CORP.

New York, New York

This company is exhibiting in 50 sq. ft. of floor space its full line of Aviation Goggles. These include the "Lamoglass", the new "Seesall" and the new "Navigator" The company is also exhibiting its complete line of new Northeaster Flying Togs. Pictures and miscellaneous literature pertaining to the products being displayed are also a part of the exhibit. Mr Beck is in charge of the exhibit and is being assisted by Mr Brook and Mr Garfine.

B. G. CORP.

New York, New York

In a display area of 100 sq. ft. this company is exhibiting a complete line of B G mica aviation spark plugs including the B G Hornet There is also a display showing the methods of construction and materials used in the manufacture of these plugs. Methods of testing the spark and insulation are also shown. The B G mica aviation spark plug is of two piece construction with mica insulation. The mica used is unbreakable and of high electric strength It possesses a resistance to heat and the plug is cleaned easily and has no extra plug gap in the terminal nut to overcome fouling. B G. plugs were used by Commander Byrd in his flight to the North Pole, the Army Around the World Flight, and various other famous flights. George M Paulson is in charge of this exhibit.

BOHN ALUMINUM & BRASS CORP.

Detroit, Mich

The exhibit of this company which covers 100 sq. ft. of floor space consists of the products which it is making for airplane engine builders. The exhibit includes aluminum castings of various kinds such as are used in engines for which the company is furnishing parts, both Bronze Back Babbit Lined Bearings and Steel Back Babbit Lined Bearings, and two piston castings. One of the features of the exhibit is a type of bearing used for Master Rod Bearings in the famous Wright Whirlwind Engines The exhibit is in charge of C. M. Adams.

BREWSTER & CO., INC.

Long Island City, New York

This company is exhibiting in 250 sq. ft. of floor space two floats manufactured for the Bureau of Aeronautics, Navy Dept. One is a complete all metal strong aluminum alloy float designed for a total submerged displacement of 6115 lb. The float is suitable for use on either the F3B-1 Boeing Shipboard Fighter or the O2U-1 Vought "Corsair" Observation Plane. It is considered the lightest ever placed in production, having a displacement of approximately 20 lb. per pound of float, which is one of the highest ratios ever obtained in an all metal float built to Navy specifications and requirements and capable of being catapulted. The interior is constructed of practically only extruded metal and tubes, and the bottom of the float is bolted with special machine screws. This permits easy removal for repairs or replacements. There is incorporated in the design a resilient nose bumper the continuity of which insures the streamline form.

There is also being exhibited a framework, without covering, of a Monel metal float designed for the UO1-C Vought airplane showing the very intricate sheet metal construction. This float is practically immune from corrosion and although

An all metal main float for the Vought O2U-1 built by the Brewster Co.

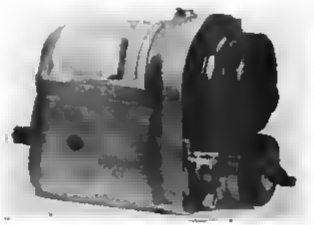
the metal itself is over three times as heavy as aluminum alloys the float when completed is approximately only 10 per cent heavier than a similar dural float As no commercial floats can be spared for the exhibit a cutaway model of the forward end of a float is being exhibited to show the unusual sturdy construction It also demonstrates the ease with which the interior can be cleaned or repaired.

The wing tip floats exhibited are those developed by the company with one piece top and bottom and streamlined remarkably well

ROBERT BOSCH MAGNETO CO., INC

Long Island City, N. Y.

The exhibit of this company which covers 200 sq ft. of floor space is featured by the showing for the first time of type "GF" Super-Energy magnetos for seven and nine cylinder radial aircraft engines. Original Bosch GF magnetos are of the inductor type giving four sparks per revolution. Armature windings and interruptions are stationary instead of rotating as in other types of Robert Bosch magnetos. The



A Type GF Super-Energy magneto for radial engines

inductor rotors are of small diameter, light weight and are made in one piece with their drive shafts. This reduces their inertia to a minimum and prevents engine vibration from effecting the operation of the magnetos The rotor shafts are mounted on ball bearings which are permanently lubricated with a special grease which does not have to be renewed unless the magneto is disassembled. Distributor gear bearings are fitted with an oil reservoir of generous dimensions so that these magnetos are operated for long periods without attention. Like other original Bosch Super-Energy magnetos, the GF types have one piece cast aluminum frames and

are fully dirt and water proof. The magnetos and windings are fully enclosed but are made accessible by removing a cast aluminum dust cover. Provision is made for the use of a hand operated booster magneto to furnish a starting spark. A. J. Poole, manufacturers' sales manager is in charge of the exhibit.

BUTLER MANUFACTURING CO.

Kansas City, Mo.

The feature of this exhibit which covers 100 sq. ft. of floor space is the showing of a model steel airplane hangar patterned after the Butler Steel Hangar which was put up for the Marshall Flying School owned by the Nicholas-Beazley Airplane Company, Marshall, Mo. Like the company's big steel hangars, the model is made with wall and roof sheets of 24 gauge tight seated galvanized steel. The sheets have the deeply panelled corrugations that are unique with Butler

Butler Steel Hangar used by the Marshall Flying School

Hangars. The model shows how the sheets are bolted together and to the steel frame with galvanized bolts. It also shows the wide span of the building, the excellent lighting conditions that are made of the hangers, and the ease with which the doors can be operated. In addition, the model demonstrates the ease with which Butler Hangars can be erected, their completeness, the economy of their enlargement, and also the simplicity of their being moved and re-erected with practically no loss at all. H. White, advertising manager of the company, is in charge of the exhibit.

CASS TECHNICAL HIGH SCHOOL

Detroit, Mich.

In a display area comprising 400 sq. ft. the Cass Technical High School is exhibiting gliders that have been made by its students in aeronautics. The gliders are of the biplane type, with a wing spread of 20 ft., and a cord of 52 in., giving a calculated landing speed with a 150 lb. pilot of approximately 20 m.p.h. The construction throughout is of wood and fabric with wire bracing. The wing section is a modified Clark Y.

According to the officials of the school the main reason for this work is to develop greater interest in gliders and glider building in this country. At the present, classes have under construction eight gliders, and at an early date a number of Detroit boys will be taught to fly them. The head of the Aeronautics Department of the Cass Technical High School is A. D. Althouse.

CANVAS-LEATHER SPECIALTY CO.

Trenton, N. J.

This company is exhibiting in 200 sq. ft. of floor space a full line of winter and summer flying suits, summer and winter helmets, radio helmets, face masks and wind cones. The company has been furnishing this equipment to the Army and Navy and the Department of Commerce for some time. All of its "Snappy-Snug" flying clothes are made according to government specifications. The company states that it uses nothing but the finest material obtainable and considers its workmanship of an unexcelled nature. Only recently it was awarded Navy contracts for crash helmets and summer helmets. Stanley Switlik, president of the company, is in charge of the exhibit.

CLEVELAND PNEUMATIC TOOL CO.

Cleveland, Ohio

This company which is exhibiting in 100 sq. ft. of floor space is showing Aerol Shock Absorbing Struts. This new type of landing gear which is fitted to many of the planes on exhibition at the Show operates on the compressed air and oil principle, similar to the Grass Air Spring which has been used for many years on trucks and busses for shock absorption. It is claimed by the manufacturer that Aerol Struts absorb without recoil landing impact equal to several times the weight of the loaded plane. The struts are manufactured in various sizes, one for each weight class of plane. They are now offered as standard equipment by many leading manufacturers. In the opinion of the manufacturer it is such products as Aerol Shock Absorbing Struts that will hasten the public acceptance of air travel that is so necessary to the proper development of the industry.

An Aerol shock absorbing strut

CROUSE-HINDS CO.

Syracuse, New York

In 200 sq. ft. of floor space this company is exhibiting its complete line of airport lighting equipment which includes such items as revolving beacons, landing field lights, airport projectors, boundary lights, obstacle light, marker and approach lights, wind sock and wind tee lights, ceiling projectors, and course lights.

The revolving beacon being exhibited is known as type DCB24 and is equipped with a cast aluminum barrel, cast aluminum trunnion arm, and a cast aluminum base. The motor reduction bearing contact rings and all other mechanism parts are mounted under the base and are protected by an enclosing casing. This beacon is equipped with any of the standard Government code wheels for flashing the auxiliary course lights.

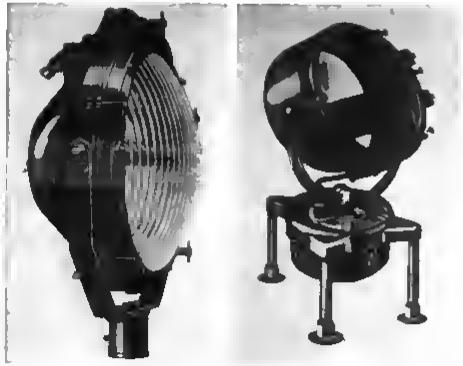
The landing field light is type LCE24 and is a floodlight projector equipped with a separate lens to spread the light in a horizontal plane without changing the natural beam spread of the vertical plane. Three different spread lenses are available, 40 deg., 60 deg., and 80 deg. The projector is provided with a set of vanes or louvers which cut off all stray light above the horizontal.

The type AKP 180 deg. airport projector being shown consists of a glass reflector of such design that the vertical spread is limited to a very few degrees but it has a horizontal spread of 180 deg. It is designed to take lamps up to and including 1500 watt with either the Mogul screw or the two-prong base. It is also provided with a system of vanes or louvers and is made of cast aluminum and is arranged for mounting on top of 2½ in. pipe.

The ceiling projectors being shown are known as type DCE14 and type DCE11. The first has a 14 in. diameter reflector and the other an 11 in. diameter reflector. Both are equipped with vanes or louvers to cut off the spill light. The 14 inch projector is made with a cast aluminum casing and the other is made with a sheet metal case. Both are wea-ther-

proof and both are equipped with two-way focusing mechanism and peepsights for adjusting the lamp at the focal point of the reflector. On one side there is a quadrant and pointer.

The type DCE Course Light consists of a 14 inch diameter parabolic reflector mounted in a cast aluminum casing. It



Left, Type LCE24 landing field light. Right, Type DCB24 revolving beacon

has a standard Mogul screw base receptacle which is mounted on a two-way focusing mechanism and the barrel of the projector is equipped with peepsights. The front lens is a 40 deg "Spredlite" lens made of special red glass.

CURTISS AEROPLANE AND MOTOR CO., INC.

Garden City, N. Y.

The accessory exhibition of this company is featured by a complete showing of Curtiss-Reed metal propellers. The Curtiss-Reed metal propeller is stated to be the pioneer in this field, the first propeller having been successfully flown in 1921 at Curtiss Field, Long Island. Official recognition of this

Curtiss-Reed duralumin propeller, Type A

propeller came in 1923, when the Navy Curtiss racers which took first and second place in the Pulitzer Trophy Race, and the Navy Curtiss racers which duplicated this feature in the Schneider Cup Race in England, were equipped with Curtiss-Reed propellers. The officials of the company state that since that time every Pulitzer and Schneider Cup winner has used

Curtiss-Reed duralumin propeller, Type D

the Reed propeller. This type of propeller has been adopted by both the Army and Navy. It is made of duralumin and two standard types are being exhibited. The original "D" type which is twisted from a flat slab of rolled duralumin and the new "R" type which is forged from a solid ingot of metal. Various stages in the manufacture of both types are shown, and there is also being exhibited the "A" type, a modification of the twisted slab type of propeller equipped with a new steel hub which it is stated has proven highly satisfactory in tests.

DETROIT AIR APPLIANCE CORP.

Detroit, Mich.

The exhibit of this company, which covers 100 sq. ft. of floor space, includes the necessary circulars and parts of its product, the Heywood High Pressure Injection Starter, mounted on a board. The main feature of the exhibit is a starter mounted on an OX-5 engine which is located immediately outside the building to permit actual demonstration of its operation. The Heywood High Pressure Starter is adaptable to any internal combustion engine for aircraft, speed boats, automobiles, trucks, tractors, etc., and consists of a small automatic pump with compound distributor. The pump maintains a constant pressure in a small tank of a capacity of ½ cu. ft. air at a pressure of 300 to 400 lb. A minute quantity of pure compressed air, released by pressure on a starter button, turns the engine over to firing position. Simultaneous with reaching this position a properly carbureted mixture of gasoline, atomized at 350 lb. pressure, is forced into the cylinder in cycle order. The start is instantaneous with the pressing of the starter button.

The manufacturer states that one filling of the small air tank will, when used with the Heywood Compound Distributor, start a 400 hp. Liberty engine 12 to 15 times without any assistance from the pump. The pump, however, replaces the amount of air used for one start in less than two minutes. Thus the tank is automatically refilled and automatically cuts off from the pump when full. This unit, complete for a 400 hp. Liberty, Curtiss D-12, OX-5, Packard, Wright I, Wright J, etc., consisting of the starter unit, tank, starting and check valves, automatic control, and copper tubing has a total weight of less than 30 lb. Complete starting apparatus for three engines of 400 hp. each weighs about 45 lb. George Fritsche, assistant sales manager, is in charge of the exhibit.

THE DE VILBISS CO.

Toledo, O.

The exhibit of this company consists of such items of its standard Spray-finishing System as are best adapted to the finishing and refinishing of airplanes. The equipment on exhibition for the application of paint or other finishing material to airplanes is no different from that used in the finishing and refinishing of automobiles with the exception that in the case of the former, larger and specially designed spray booths are very often required. As the exhibit floor space is only 200 sq. ft. a plain spray booth has been omitted.

The items of standard equipment on display consist of a Type AV Spray Gun, Suctions and pressure feed material Containers, Air and fluid hose, Air transformers, Dusters, Heaters, Hose Cleaners, etc. A portable painting unit may be included in the display also.

The Type AV Spray Gun provides advantageous application of any paint, varnish or lacquer material on any kind of surface. All nozzle parts are self centering. The ball and cone construction used insures fluid tip and air cap being held in positive concentricity at all times; prevents air leakage, and provides for complete interchangeability of parts without disturbing concentricity of tip and cap. Other points are quick detachable spray head, simplicity of design all metal construction, quick fluid needle adjustment, gun handle designed to hand, good balance and free trigger action, etc. The Type HL Air Transformer is built of hard brass and bronze, nickel plated. It is provided with an extra large

condenser tube, equipped with a series of baffles through which the air passes. These baffles collect the oil and moisture, drained by means of the valve at the bottom, making the purifying operation automatic. There is one gauge for indicating the main line pressure, and another for the regulated pressure. The Air Duster, Type DG, is attached to one outlet of the Air Transformer, so that it receives air at the main line pressure, free from oil and moisture. The body is aluminum, with brass nozzle. A special attachment (RR-402) is of advantage where dust from sand papering is to be removed. It is attached by replacing the regular nozzle.

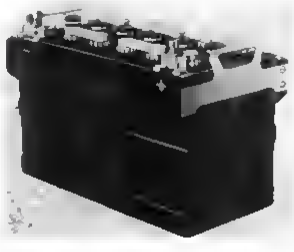
A De Vilbiss spray gun, Type AV

De Vilbiss Hose for both air and fluid is in standard lengths of 15 ft. and 25 ft. Other lengths are also furnished as well as couplings for connecting two lengths together. The Type HD Hose Cleaner provides for keeping the fluid hose clean by forcing a spray of solvent through the hose, thoroughly removing all finishing material from inside lining. Complete descriptive literature is obtainable at the De Vilbiss booth.

ELECTRIC STORAGE BATTERY CO.

Philadelphia, Pa.

In a display area of 150 sq. ft. of floor space this company is exhibiting its line of Exide batteries for all types of aircraft service. The battery which is used mostly for this type of service is type 6-TX-19. The Electric Storage Battery Co. has been developing and producing storage batteries for aircraft service since the first requirements were determined for Liberty engines. It has continued its production of a standardized line of aircraft batteries for all purposes as well as cooperating with the Army and Navy on the development of aircraft batteries for special purposes. Standard aircraft Exide batteries were used on the Pan-American Good Will Flight and by practically all of the entrants in each of the Ford Reliability Tours. They were also used on all trans-oceanic flights attempted and completed where radio or special lighting equipment was used, including Commander Byrd's flight to the North Pole and the Sterling Exploration to Dutch New Guiana. H. G. Carron and M. W. Turner are in charge of the exhibit.



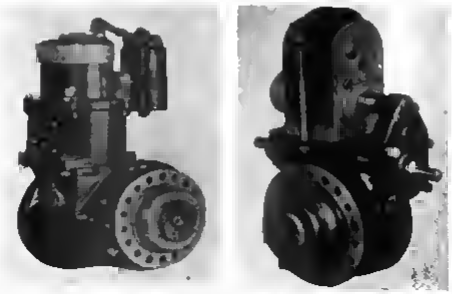
Type 6-TX-19 Exide battery

ECLIPSE MACHINE CO.

East Orange, N. J.

The exhibit of this company, which covers 160 sq. ft. of floor space, is featured by the showing of various types and forms of starters of different sizes to suit engines of various sizes. In particular the exhibit includes an Eclipse Series 6 and a Series 7 Combination Hand and Electrically operated Inertia Starter, an Eclipse Hand Turning Gear, as fitted with Booster Magneto, and an Eclipse 25 ampere, 15 volt, voltage regulated generator.

Series 6 is known as a concentric type due to its structure being arranged centrally around the application flange. Because of its construction this type of starter is particularly adapted for use on radial engines offering a minimum of interference with other accessories usually applied to the rear



Left, an Eclipse Series VII combination hand and electrically operated inertia starter with Hart magnetic switch. Right, hand starter with booster magneto integrally mounted.

of such engines. It is suitable for engines up to 1350 cu. in. displacement maximum. Arranged for a combination hand and electric operation it weighs 24½ lb. for land service and 27½ lb. for marine service. Arranged for hand operation alone it weighs 17½ lb. for land service and 19½ lb. for marine service. The Solenoid Switch weighs 3 lb., the crank handle 2¾ lb., and the crank extension 1¾ lb. Series 11 is identical in appearance with Series 6, the difference being only that it is larger and capable of starting engines up to 2500 cu. in. displacement.

Series 7 has the same capacity as Series 11 but its general design makes it adaptable for use on large V type engines.

An Eclipse 25 ampere voltage regulated generator with control box.

It is of the vertical type and the over-all length is six and one-half inches. The length is not increased by the addition of the electric attachment. Arranged for combination hand and electric operation it weighs 35 lb., and arranged for hand operation only it weighs 27 lb. The other weights are the same as Series 6.

The Eclipse hand turning gear, as fitted with booster magneto, is regularly furnished having three different radius

It is designed for cranking the engine directly by hand power. For use on magneto equipped engines the hand turning gears are furnished having a Booster magneto integrally mounted and geared upward from the hand crank shaft. For engines equipped with battery ignition the Booster magneto is omitted. The three ratios mentioned are 6:1—for engines up to 900 cu. in. displacement; 12:1—for engines up to 1400 cu. in. displacement, and 18:1—for engines up to 2000 cu. in. displacement. With booster magneto it weighs 28 lb., and without booster magneto it weighs 17¼ lb. The crank handle and crank extension weights are the same as the others.

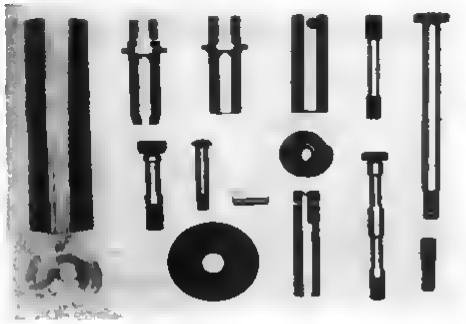
The Eclipse voltage regulated aviation generator is furnished complete with separate mounted control box containing the voltage regulator unit and cutout. It is of the engine driven type and weighs 20 lb. The control box containing voltage control mechanism weighs 2 lb. The Eclipse 15 ampere, 15 volt engine generator is identical in appearance to the 25 ampere machine. Its weight is 15 lb. and the control box weight is 2 lb. A. E. Raabe is in charge of this exhibit.

EX-CELL-O TOOL AND MFG. CO.

Detroit, Mich.

This exhibit which covers 200 sq. ft. of floor space is featured by the showing of the Ex Cell-O Diamond-Boring Machine, equipped with XLO Spindles for rotating the diamond, in actual operation. The exhibit also includes the company's line of Drill Jig Bushings upon which many manufacturers have standardized. There is also a complete showing of high grade precision aircraft parts, as well as XLO High Speed Precision Ball Bearings especially designed for grinder and diamond-boring spindles, which are claimed to have a feature common to no other ball bearing.

In XLO High Speed Precision Ball Bearings the tracks in the raceways are developed to a mirror finish of the utmost precision by the Alden developing process. This is stated to take out all preliminary wear and give a bearing with end and radial play restricted to .0001 in. This accuracy is maintained over a long period of time without adjustment. Another feature of the exhibit is a line of different precision parts made by the company for Diesel engine builders.



Examples of fine precision aircraft parts manufactured by Ex-Cell-O Tool & Mfg. Co.

ELGIN NATIONAL WATCH CO.

Chicago, Ill.

In a display area of 100 sq. ft. this company is exhibiting three types of instrument boards. Type TA is directly lighted and contains an Elgin chronometric tachometer, Army Type C altimeter, oil pressure gauge, oil temperature gauge, Elgin 30 hr. clock and either an ammeter or a water temperature gauge. The board is lighted with a 2 cp. Mazda lamp.

The other two boards are indirectly lighted. One contains the Elgin tachometer, which is the main feature of the Elgin exhibit, and two other gauges. The third board also contains the tachometer but it has four other gauges. The three boards are covered with glass and are fitted with a polished chromium plated bezel. The weight of each board with oil temperature line is 5 lb. 10 oz. The Type TA board was described in detail in AVIATION Nov. 21, 1927.

EMBRY-RIDDLE FLYING SCHOOL

Cincinnati, Ohio

The exhibit of this company which covers 100 sq. ft. of floor space features the aims, policies and activities of the Embry-Riddle Flying School. This flying school which operates at the Lunken Airport is headed by Raymond D. Harris. Only recently this school was successful in soloing a student in one day. The student was Frank W. Shelton, a fourth year student in the pre-medical class at the University of Cincinnati, and the amount of dual instruction that he received was five hours and 34 min. His instructor was Pilot Rader. During the instruction Shelton made a total of 74 landings and then Rader stepped out of the plane and sent him solo. After getting off the ground he circled the field a few times and then made a landing which, according to observers, was exceptionally good. This company is associated with the Embry-Riddle Co., of which John Paul Riddle is general manager. The Embry-Riddle Co. operates the Chicago-Cincinnati Contract Air Mail Line.

Four training planes of the Embry-Riddle Flying School, Lunken Airport.

FAIRCHILD AERIAL CAMERA CORP.

Subsidiary of the Fairchild Aviation Corp.

Farmingdale, L. I., N. Y.

This exhibit consists of the Fairchild type K-8 fully automatic recording aerial camera. This camera is of the single lens type and registers time "to the second" that the photograph was taken. It can be equipped to accommodate lenses of focal length varying from 21 cm. to 50 cm. Speeds of the camera are adjustable for 1/50 sec., 1/100 sec., and 1/150 sec. In connection with this particular exhibit there is a display of various aerial views and maps made and produced by Fairchild Aerial Surveys, Inc., another subsidiary of the Fairchild Aviation Corp. A description of the Fairchild type K-8 camera appeared in the Feb. 28, 1928 issue of AVIATION.

THE GOODYEAR TIRE AND RUBBER CO., INC.

Akron, Ohio

The exhibit of the Goodyear Co. covers 300 sq. ft. of floor space and is featured by a complete display of airplane tires, tubes, aircraft gasoline, radiator hose, shock absorber disc

and all rubber products for use in the manufacture and assembly of airplanes. In addition there is an interesting lighter-than-air exhibit consisting of various models of dirigibles. There is also a collection of interesting photographs and an exhibit of ballooning equipment. Literature describing in detail the equipment on display is obtainable at the Goodyear booth, and L. O. Guinther, who is in charge of the Airplane Division, Aeronautics Department of the Goodyear Co., is in charge of the exhibit.

B. F. GOODRICH RUBBER CO.

Akron, Ohio

The Goodrich exhibit takes up 300 sq. ft. of floor space and contains plain tread and non-skid airplane casings, inner tubes, shock absorber cord and shock absorber rings, gasoline and radiator hose, shock absorber discs and special molded parts. The strictly new items are the non skid airplane casings which are in three new sizes. Miscellaneous literature and a specially prepared catalog is distributed at the Goodrich Co. exhibit. R. N. Ellis is in charge of the Aeronautical Sales Division of the B. F. Goodrich Rubber Co.

HASKELITE MFG. CORP.

Chicago, Ill.

This company is exhibiting in 200 sq. ft. of floor space samples of Haskelite blood glue plywood, a product which the company has been manufacturing since 1917. The company supplies panels as thin as 1/16 and 3/32 in., and has made panels 1/30 in. in thickness.

The exhibit contains samples of Haskelite used for fuselages, leading edges, engine bearers, flooring, tail linings, center ribs, tank cover, center cover, pontoon parts, walkway ribs, wing ribs, box beams, seats, rudder, step boards, drag ribs, end and tail ribs, walkway, head pads, propeller spinner, wing covering in slip stream, bulkheads or partitions, pontoon covering, aileron or elevator surfaces, instrument boards, after deck bulkheads, webs and wing spars, bracing instead of wire, gusset plates on fuselages, and on landing gear struts like box struts. Included also in this exhibit are samples of Haskelite airplane parts furnished to many of the leading aeronautical companies.

The Haskelite exhibit is in charge of James R. Fitzpatrick, assistant secretary and treasurer, Howard B. Dunton, sales representative, and Emory W. Stoner.

HARTZELL PROPELLER CO

Piqua, O.

In a display area of 100 sq. ft. this company is exhibiting its line of standard propellers including Wright Whirlwind and OX-5 designs. These propellers are of laminated wood construction after conventional practice.

One feature of the exhibit is a duplicate of the propeller used on the Whirlwind powered Bellanca monoplane in which Acosta and Chamberlin established the world's endurance record, and also in which Chamberlin and Levine established the world's distance record in the flight from New York to Germany. Another feature is a display showing the various manufacturing stages in the production of a Hartzell propeller. Ventilating equipment using aviation propellers is also included in the Hartzell exhibit.

HAMILTON AERO MFG. CO.

Milwaukee, Wis.

This company is exhibiting in 300 sq. ft. of floor space its complete line of wood and metal propellers and several types of metal pontoons. Among the metal propellers on display is a newly developed three piece, adjustable pitch, adjustable diameter propeller using a screw type hub and blade end, instead of the conventional split hub. This propeller is interesting inasmuch as it incorporates light weight, aerodynamic efficiency and strength. Several other specially designed propellers for the many new aircraft engines are also shown.

The wooden propeller display includes several propellers which incorporate an aluminum spinner assembly that has been recently developed by the Company. The particular features of this spinner is its simplicity (only one nut being required for attachment) and that any size may be attached to the same propeller without the necessity of any changes. This same type of spinner is also used with remarkable success on the various types of metal propellers.

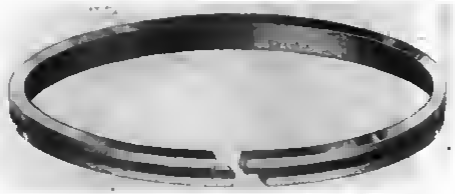
The all-metal pontoon display consists of one flat deck type pontoon of 2200 lb. displacement and one round deck type pontoon of 4000 lb. displacement. There is also shown a section of the large pontoon showing in detail the internal structure. The exhibit is in charge of A. Nelson and A. B. Lord.

JOHN C. HOOF & CO.

Chicago, Ill.

The display of this company covers 100 sq. ft. of floor space and is featured by the showing of Hoof Self-Lubricating Graphoil Piston Rings and Hoof-Randall Graphite-Filled Self Lubricating Valve Guides.

Hoof Graphoil Piston Rings are manufactured with a locking groove machined in the outer surface. This is packed with Graphoil permanently locked in the ring and gives positive lubrication at all times. Graphoil is stated to be a special compound treated to prevent break down under extreme engine temperature, oil conditions, etc.



A Graphoil Self-Lubricating Piston Ring

The Hoof-Randall Valve guide has a close grained cast iron body, machined finished all over and made to exact dimensions. Helical grooves are filled with compressed graphite flush with the bearing surface. The plain or lubricated valve guides are stated to require no reaming to install. A. C. Hoof, president of the company, is in charge of this exhibit.

IRVING AIR CHUTE CO., INC.

Buffalo, N. Y.

The exhibit of this company which covers 100 sq. ft. of floor space is featured by the showing of the Irvin Air Chute, a life saving parachute for emergency use. There are also numerous photographs showing the air chutes in action as well as miscellaneous descriptive literature. The outstanding feature of the Irvin Air Chute is the fact that this equipment has already saved over 100 lives in emergencies covering practically every form of aircraft accident. The fact is worthy of mention that the Irvin Air Chute was worn by Colonel Lindbergh when he made his four jumps during his service as a mail pilot.

The Irvin Parachute is a free type, manually operated parachute. It is operated by a slight pull on the "pull ring" which is located in a readily accessible place on the harness.

The Irvin Air Chute is made in three sizes, which are, 24 ft. in diameter for general service use, 28 ft. in diameter for exhibition and training jumps, and 22 ft. in diameter to be used in conjunction with the 28 ft. air chute for exhibition and training jumps. The 24 ft. air chute has been adapted by several governments as standard equipment for their airplanes. It is known as the "Service Parachute" and is packed in three types of containers, viz., the seat pack, lap pack, and back pack. The seat pack is used as a seat cushion and is most generally used by pilots. The lap pack has been developed for the use of machine gunners and photographers. The back pack has been designed for use in balloons, airships and other types of lighter-than-air craft and also certain types of heavier-than-air craft. Complete with harness and any of the types of containers mentioned the weight of the

Eight jumpers coming down with Irvin Air Chutes. They all leaped from a Navy transport plane in less than 15 sec. elapsed time.

Service Parachute is approximately 18 lb., the rate of weight descent is 16 ft. per second. The average rate of descent for the 28 ft. air chute is 12 ft. per second.

The Irvin Air Chute is secured by a special woven webbing harness. The woven webbing has a tensile strength of 3000 lb. and is reinforced on all metal parts. The harness is adjustable. The metal parts of the snaps and adaptive buckles are made of chrome nickel steel and have a tensile strength of 5000 lb., and are either galvanized or cadmium plated. The body fabric is a specially woven high grade silk developed by the company. The suspension or shrond lines are silk cords of 400 lb. tensile strength. Ventage is taken care of by the special weave of the silk fabric in conjunction with the vent incorporated in the apex of the chute.

A small miniature parachute termed the "pilot chute" is attached at the apex of the air chute by means of a separate silk cord of 400 lb. tensile strength. It is 30 in. in diameter and is constructed with steel ribs and a spring in such a manner that it folds up under tension and is packed thus folded in the container. George Waite, president of the company, is in charge of the exhibit.

JOHNSON AIRPLANE & SUPPLY CO.

Dayton, O

This company is exhibiting in 300 sq. ft. of floor space a complete working display of its new products and special equipment for airplanes which includes the Johnson All Steel Disc Wheel, with and without internal brakes, a model of the Adjustable Pilot's Seat, and an Approved Gasoline System. The Johnson Standard fittings, bolts, etc., are being shown as well as a new non-shatterable wind shield, the new Johnson Avigo Compass, air speed indicator, improved speaking tubes, metal pontoons, first aid kits, automatic flash fire extinguisher, etc.

The All Steel Disc Wheel which is 30 x 5 in size was recently tested at Wright Field to destruction and failed at 4,000 lb. above the required load of 11,000 lb. The exhibit contains two models of this wheel, one with, and one without Hyatt Roller Bearings. The wheel accommodates three sizes of tires; the 28 x 4, 30 x 5, and the 32 x 6.

The Adjustable Pilot's Seat not only accommodates pilots of different sizes but permits the pilot to raise himself for better vision in landing, or lower himself for greater comfort while in flight. The seat is arranged for the seat type parachute and is a development of the recent crash tests to provide the greatest amount of protection in such an event.

The Approved Gasoline System being exhibited has been arranged to comply with Air Corps and Department of Commerce Regulations and incorporates all the latest approved accessories and fittings that are now standard. It is possible for the visitor in the [illegible] to trace the system [illegible] and follow the course of the fuel through the various units. A diagram is also a part of this display, and descriptive material may be obtained upon request. E. A. Johnson, president and general manager of the company, and D. M. Dunlap, chief engineer, are in charge of the exhibit.

KELTON-AURAND MANUFACTURING CO.

Bay City, Mich.

This company is exhibiting in 100 sq. ft. of floor space its latest seat developed for the Stinson Aircraft Corp. This consists of a seat with a swinging back so that the passenger may, at will, sit facing the front or the rear. Should a full length couch be desired the back of the seat folds down so as to form a comfortable bed. The data and experience gained by E. C. Kelton, president of the company and an ex-war pilot, and his engineers, who spent as much of their time as possible in flying the existing passenger air lines, have proved of great value in developing this seating equipment which will offer the necessary comfort factor for the passenger and at the same time prove strong and durable and come within the weight limitations of the designing engineer. The exhibit is in charge of A. L. Harris, general manager, and Chas. E. Stone, manager of the Aviation Department of the company.

KENDALL REFINING CO.

Bradford, Pa.

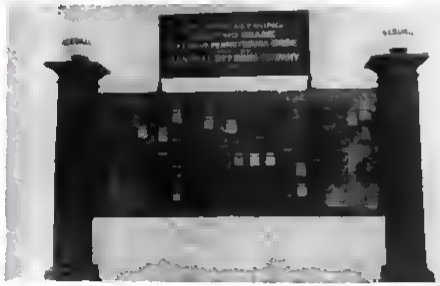
The exhibit of this concern covers 200 sq. ft. of floor space, and contains a large animated sign, or process board which describes the process of refining Bradford grade of Pennsylvania Crude Oil in a most comprehensive way within a few minutes.

The Process Board is made of hammered iron and is mortised. Each slot contains an electric bulb, in front of which is a flask either of crude oil or one of the forty or more products made from Bradford Crude. The first operation shown is light back of the flask containing Bradford Crude, then another light leading in two different directions from the crude and still another light back of a flask of gasoline distillate and steamed crude indicates that the first process in refining is accomplished by steam distillation and produces gasoline distillate and steamed crude. The lights in the board are operated on a flasher system and remain lighted for five seconds after each process has been completed.

Following the first process the light again appears back of gasoline distillate. Several other lights indicate that this is further divided into high test gasoline and motor gasoline, with a light back of each of these flasks. This again remains

lighted for five seconds and is followed along by the other processes until each one is complete within itself and the crude oil divided into more products than the average person has any idea are contained in crude oil.

The process shows the thoroughness and indicates that a vast amount of equipment must be necessary for the many



The Process Board of the Kendall Refining Co., Bradford, Pa.

ramifications that occur in refining. The exhibit is in charge of I. H. Shearer, treasurer and sales manager of the Company, assisted by Frank Philippbar, lubricating engineer, Julius Heyden, Newark, N. J., representative, and M. C. "Bob" Loutt, High Point, N. C., representative.

THE LEECE-NEVILLE CO

Cleveland, O

The exhibit of this company which covers 200 sq ft of floor space is featured by the showing of the company's line of voltage regulated generators for aeronautical use. These generators insure steady voltage as a protection for all lights, instruments and other wiring. They are driven from the engine and are designed to operate at 15 volts in capacities of 15 amp., 25 amp., and 50 amp. As they are so regulated the size and weight of the storage battery can be reduced to a minimum. They will not burn out the storage battery from overcharge.

MACWHYTE COMPANY

Kenosha, Wis

In a display area of 100 sq. ft., this company is exhibiting such items as streamline tie rods, round drawn tie rods, clevis end fittings, lock nuts and clevis pins, the Macwhyte safe lock terminals, aircraft cord, strand and wire. Photographs

A Macwhyte round drawn tie-rod.

showing the use of Macwhyte equipment on different makes of airplanes are also a part of the exhibit. The Macwhyte company supplies many of the manufacturers of airplanes with its streamline tie rods for use on government as well as commercial planes. It also supplies streamline tie rods to the Air Corps, War Department, and Naval Aircraft Factory. The round drawn tie rod which is claimed to save 40 per cent. in weight, has a reduced center section and is claimed to be absolutely uniform as to physical properties and structure. Extra strong wrench grips, as approved by the Army and Navy Standardization Committee are used. The Macwhyte safe lock terminal is so designed that the nut can be screwed up as tightly as possible without injury to the tie rod, no extra spring being set up. No moisture can find its way in to the detriment of the threads, and the maximum strength of these threads is also attained. The company manufactures the standard aircraft cord in 7 x 7 and 7 x 19 construction and also the standard 1 x 19 aircraft strand. This material is manufactured in accordance with Army and Navy specifications.

METALBOAT DIVISION
Fairchild Airplane Manufacturing Corp.
Subsidiary of the Fairchild Aviation Corp.

Farmingdale, L. I., N. Y.

This exhibit consists of the Fairchild pontoon which is of composite construction having wood members and metal fittings with duralamin covering. It is of special step design

Front quarter view of a set of Fairchild pontoons

with a concave V bottom and a Kapok nose bumper. The tube is built through the pontoon just in front of the step. For beaching purposes an axis may be slipped through this tube thus eliminating the necessity of handling trucks. The Fairchild pontoon was described in detail in the Sept. 12, 1927 issue of AVIATION.

NORMA-HOFFMAN BEARINGS CORP.

Stamford, Conn

This exhibit which covers 200 sq. ft. of floor space is featured by Norma-Hoffman ball and roller bearings. According to the officials of the company these polished carriers

Norma-Hoffman precision ball and roller bearings

are of almost frictionless motion. The precision fit of these parts represents a refinement of workmanship equal only in fine instrument making. The exhibit consists not only of ball, roller and thrust bearings manufactured by the company but also shows typical applications. At the company's booth is to be found precision bearings fitted to crankshafts,

starters, magnetos, generators, fuel pumps, superchargers and aviation instruments.

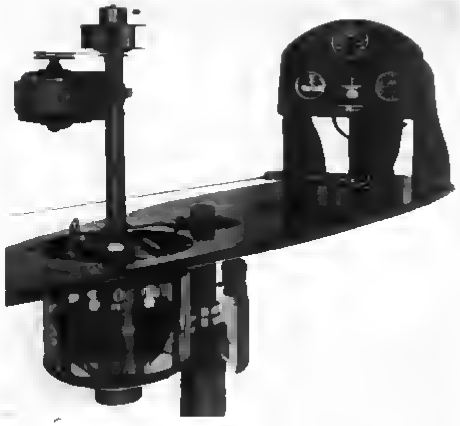
The company is represented at the Show by O. P. Wilson, V.P., Norman Bell, asst. secy., F. W. Messenger, New York District Mgr., D. E. Batersoll, asst. engnr. Mgr., L. I. Wightman, adv. mgr., R. E. Hicker, Cleveland mgr., and T. J. Harley, Chicago mgr.

PIONEER INSTRUMENT CO., INC.

Brooklyn, N. Y.

The feature of this exhibit which covers 200 sq. ft. of floor space is the showing of an earth inductor compass similar to those used by Colonel Lindbergh, Clarence Chamberlin, and Commander Byrd on their famous trans-Atlantic flights. A cut-away model of this unit is mounted on a finished revolving pedestal to simulate an airplane and is operated by an electric generator so that the spectator may see every moving part in actual operation.

The "Flying Showcase" is on exhibition at the Ford Airport. This plane is owned by the Pioneer Instrument Co. and is equipped with a complete set of Pioneer instruments.



A cut away model of the Pioneer Earth Inductor Compass mounted on a revolving pedestal and operated by an electric generator

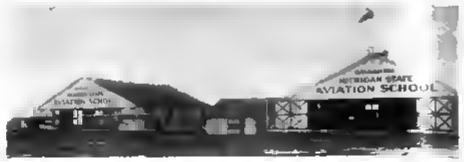
Among the many Pioneer instruments being exhibited are several standard boards fitted with flight and engine instruments. All Pioneer instruments are radium illuminated and include the air speed inductor, the climb inductor, magnetic compasses, speed and draft indicator, altimeter, etc. The engine instruments include the oil pressure gauge, tachometer, fuel level gauge, and water and oil thermometer. All Pioneer instruments are graduated in nautical or metric units and the dials may be marked in any language.

Other features of this exhibit are the Bumstead sun compass used by Commander Byrd in his flight to the North Pole, parachute flares, fuel strainer, hand fuel pumps, instrument lamps, landing lights, octants, sextants and chronometers. This booth is in charge of John C. Pearce, Jr., fuel engineer, assisted by Wesley Brown, sales representative. Charles H. Colvin, president of the company, and Morris H. Titterington chief engineer, are in Detroit during the Show.

MICHIGAN STATE AVIATION SCHOOL

Detroit, Mich.

This exhibit which is educational and included in 100 sq. ft. of floor space consists of a complete set of photographs and printed material describing the school. The Michigan State Aviation School and the Packard Flying Service are operating jointly in teaching complete ground work, flying



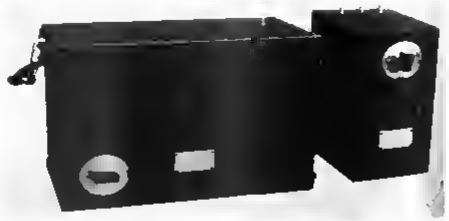
Hangars of the Michigan State Aviation School at Packard Field, Detroit

and the parachute work. Students going through the school now have the benefit of seven instructors, each a specialist in his line. The school has leased two hangars on Packard Field, and Mr. Tuohey is head of the flying service and John Workman is in charge of student mechanics. The Michigan State Aviation School is also affiliated with the Michigan State Automobile School. A. G. Zeller is president and general manager.

RADIO CORPORATION OF AMERICA

New York, New York

This exhibit which covers 200 sq. ft. of floor space is featured by the showing of the RCA 100 watt transmitter and receiver, which is being used on the Stinson-Detroiter monoplane which is making a tour of the country under the auspices of the New York American. The total weight of this set is 117 lb. The transmitter for both phone and telegraph weighs 17 lb., including tape, measures 16 in. wide, 12 in. high and 8 in. deep. The transmitter is operated from a



An RCA 100 wt aircraft transmitter, model ET3653

control box weighing 6 lb. The control box is 6 in. wide, 12 in. high and 8 in. deep and is placed convenient to the operator. By means of an interchangeable coil system the receiver has three wave length ranges, 85-100 meters, 550-850 meters and 850-1100 meters. It weighs 12 lb., including tools, and is 14¾ in. wide, 10 in. high and 2⅝ in. deep. The five tubes which are mounted on rubber include two radio frequency, two audio frequency and one detector. Power is received from a wind driven generator fitted with a Dunlap carriers constant speed propeller. This unit weighs 50 lb. and has a maximum output of 700 watts. The antennae is reeled out through a Micarta tubing fair-lead with a metal and flange. W. C. Fiske is in charge of this exhibit.

RUSSELL MANUFACTURING CO.

New York, N. Y.

This exhibit consists of three display boards mounted on easels which in a general way cover the so called "Rusco" aero products. One board is devoted to a complete set of Rusco aero rings of the different diameters and the second board is devoted to samples of all Rusco elastic products including crude rubber and sponge rubber, various diameters of straight cord and the new Rusco streamline gap cover which is fabricated from elastic material in the sheet form; the third board displays the line of non-elastic products such as braids, tapes, webbings, lacings, brake lining, etc.

A small model of a typical landing gear is also being exhibited. It is power driven; the wheels are elevated to simulate landing conditions by eccentric rollers. Another feature is an actual sample of full scale shock absorber strut design for lacing straight cord around pegs. A large amount of technical data is available for visitors to the booth including performance graphs and general information of value to designers.

B. RUSSELL SHAW CO., INC.

St. Louis, Mo.

This exhibit which covers 100 sq. ft. of floor space contains a complete working model of the St. Louis Municipal Airport showing all the buildings, runways, etc. The entire model is arranged for night lighting and so shielded that the illumination will automatically dim out, representing the coming of night, when the night airport lighting system will be turned on, and vice versa. There is also being displayed

A drawing of the Lambert-St. Louis Airport designed by B. Russell Shaw Co., Inc.

a model of brick and steel building, a product in which the company specializes. The exhibit also includes a model of the new Administration Control Building which the company is constructing at the St. Louis Municipal Airport. In addition there are photographs and plans of other fields which the company has designed or is building, and also plans of administration buildings based upon the company's past in the actual operation of air lines. The exhibit is in charge of B. Russell Shaw, president of the company, and O. S. Edgington.

SAUZEDDE CORP.

Detroit, Mich.

The exhibit of this company covers 50 sq. ft. of floor space and includes a display of Sauzedde wheels and brakes. The wheel incorporates the triple lace feature. There are three rows of spokes at the hub laced in such a manner that the spoke lengths are all equal. The manufacturer claims that there is equal strain on all of the spokes. The crossing of the

spokes allows the brake to be placed closer to the hub, thus distributing braking more uniformly.

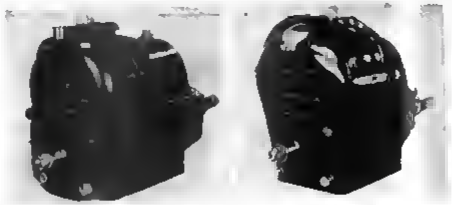
The brake is of the internal expanding type and resembles the automobile brake except that it is somewhat lighter. It is expanded by a compound cam that greatly multiplies the force applied. The brake of each wheel is operated independent of the other. The Sauzedde wheel was described in the April 18, 1927 issue of AVIATION.

SCINTILLA MAGNETO CO., INC.

Sidney, N. Y.

In a display area covering 200 sq. ft., this company is exhibiting a demonstration cabinet upon the top of which are mounted one type V-AG-9-D Scintilla magneto which is standard equipment for the Wright "Whirlwind" and "Cyclone", Pratt & Whitney "Wasp" and "Hornet" and Pitcairn-Brewer nine cylinder engines, and one type MN7-D Scintilla aircraft magneto which is standard equipment for the Warner seven cylinder air-cooled engine, the Wright seven cylinder engine, the Floco engine and the Comet engine, etc. Between these two magnetos, and slightly staggered, there is mounted a Scintilla vertical double aircraft magneto type SC which is not yet out of the experimental stage, but which is used on some of the Curtiss 12 cylinder water-cooled engines. These three magnetos are driven at varying speeds by a 220 volt D.C. electric motor through the medium of countershafts. The sparks from these magnetos are carried through brass conduits to spark gaps of various types. One model EA Scintilla aircraft switch is connected to control the type SC magneto.

The exhibit also includes two tables on which are mounted various types of magnetos. There is also being shown Scintilla aircraft magnetos suitable for installation on OX-5 and OXX-6 engines, and a small single cylinder magneto for single cylinder test layouts. Pictures of Scintilla products fitted to various engines and miscellaneous literature are also a part of this exhibit. T. Z. Fagan, vice president, is in charge of the exhibit and is being assisted by L. W. Trees.



Left, Type MN7-D Scintilla aircraft magneto. Right, Type V-AG9-D Scintilla aircraft magneto.

SNAP-ON WRENCH CO.

Chicago, Ill.

This company is showing in a display area of 100 sq. ft. a complete line of Snap-On interchangeable socket wrenches and other mechanic's hand tools specially adapted for servicing planes and engines. The feature of the exhibit is the new Snap-On Ferret Set which is an entirely new development in socket wrenches and is designed to reach the hard-to-get-at nuts and bolts on airplane engines. In addition there is a complete display of Blue Point alloy steel wrenches, tappet wrenches, gear puller chisels and punches, pliers and screw drivers. This exhibit is in the charge of R. B. Campbell, manager of the company.

SKF INDUSTRIES, INC.

New York, N. Y.

This company is exhibiting in 200 sq. ft. of floor space a range of ball and roller bearings. Several novel devices portray visually the anti-friction features of SKF bearings. In addition there is being shown the products of leading aeronautical manufacturers and component parts equipped with SKF bearings. A scenic background covering the entire back of the exhibition booth illuminated with a large Neon sign of the SKF letters in colored lamps focuses attention on a large painting showing the many flags of the world under which the company's bearings are sold and service rendered. Those in charge of this exhibit are R. O. Mangam, C. E. Drake, C. R. Mabley, W. C. Ahlers, H. M. Metz, A. T. Ludington and J. C. Northrup.

A. G. SPALDING & BROS.

New York, N. Y.

In a display area of 200 sq. ft. this company is exhibiting its complete line of aviation equipment which includes summer and winter suits and helmets, goggles, gloves, moccasins, Navy boots, etc. P. H. Hart, head of the Aviation Department is in charge of the exhibit.

SPERRY GYROSCOPE CO.

Brooklyn, N. Y.

This exhibit which covers 100 sq. ft. of floor space is featured by the showing of three of the company's light units. One is a standard type 24 in. revolving beacon of 3,000,000 cp. The second is a safety three purpose arc light. This unit can be normally used as a 1,000,000 cp. floodlight with an 80 deg. beacon for airport use. By swinging back a door on the light it can serve as a 30,000,000 cp emergency beam. This high powered beam may be used as an emergency airport light for bad weather or as an airport ceiling light. The third unit is a standard ceiling light 18 in. in diameter and having a candle power of 1,500,000. C. D. Jebsen is in charge of the exhibit.

STANDARD OIL COMPANY OF INDIANA

Chicago, Ill.

The exhibit of this company which covers 300 sq. ft. of floor space is featured by the showing of photographs of the company's 12 passenger "Stanolind" and the company's two passenger "Stanolind, Jr." Information regarding the purposes of these two planes is also a part of the exhibit. There is also being exhibited the company's products, Stanolind Aviation Gasoline, Stanolind Aero Oil and Superla Aero Oils.

The "Stanolind" getting off the ground.

Copies of the company's booklet "Multiplying Time" are distributed at the various cities where and when the Stanolind plane pays a visit. This Stout all-metal plane has carried 2300 passengers a total of 40,000 mi., and has made 10 distinct business trips carrying directors and officers of the company

for a total of 11,000 m. The aggregate mileage that the directors have flown amounts to over 38,000 m. The Stanohnd will be used this year even more extensively than last year in the promotion of aviation. It will pay visits to the numerous points in the 10 states in which the company operates and to such cities which contemplate promoting an airport.

The Stanohnd, Jr., is an E. M. Laird biplane and is to be operated and used by the manager of the Aviation Department in the solicitation of aviation accounts and supervision of sales in the Middle West. It is powered with a Wright Whirlwind engine and is fully equipped. Stanohnd Aero Oil being exhibited is a heavy bodied highly refined pure petroleum product, made especially for the lubrication of high compression heavy duty aviation engines. It resists extreme temperature without losing its lubricating body and is recommended for the lubrication of all types of aircraft engines with the exception of the rotary types

Superla Aero Oil (summer) is somewhat lighter in body than Stanohnd and is particularly recommended for use in small type training planes equipped with low pressure engines. It conforms to the U. S Government specifications for Grades 2 and 3 aero oil and the Stanohnd Aero Oil meets the U. S. Government requirements for Grade 4 aero oil Superla Aero Oil (winter) is a cold tested oil which meets U. S. Government specifications for Grade 1 aero oil. It will pour at a temperature as low as 15 degrees above zero Fahrenheit, and is recommended for flying in zero weather and altitude work where low temperatures are encountered. The revised Aviation Manual which is a part of this company's exhibit describes some of its activities toward creating interest in aviation. It also contains a complete list of names, cities and towns where the Standard Oil Co. of Ind. has painted the roofs of its warehouses with names of its representative communities

STANDARD STEEL PROPELLER CO.

Pittsburgh, Pa.

In a display of 400 sq. ft. this company is exhibiting a two blade propeller for engines of 90-110 hp., a three bladed propeller for use on Wright Whirlwind engines, hubs, blades and parts for various standard engines. The two bladed propeller and the three bladed propeller are new developments. The first has been under development for about two years. The manufacturer stated that he had taken his time in this development in an effort to produce the most efficient type ever placed on the market. This propeller, which is now in production, successfully passed whirling tests at McCook Field.

A Standard Steel propeller for the Wright Whirlwind engine

It was whirled at 100 per cent. overload. The propeller was designed after those of high horsepower now in use, and it is said that vibration has been eliminated. The three bladed propeller was designed for installations requiring a small diameter such as the center engine of Fokker tri-engined monoplanes where the discs of the standard three blade propeller overlap

STROMBERG MOTOR DEVICES CO.

Chicago, Ill.

This company which manufactures carburetors, shock absorbers, and other automotive equipment is exhibiting in a display of 100 sq ft. The features of this exhibit are cut-away models of the same type carburetor as was used by Col Chas.

A. Lindbergh, Commander Byrd, Clarence Chamberlin and Mr. Levine, Lieuts. Maitland and Hegenberger, the Army and Navy air mail planes, etc. Carburetors designed and built for military use on highly maneuverable airplanes and capable of flying up-side-down, as well as units especially adapted for commercial purposes are also being shown. A set of pictures illustrating the various products manufactured by

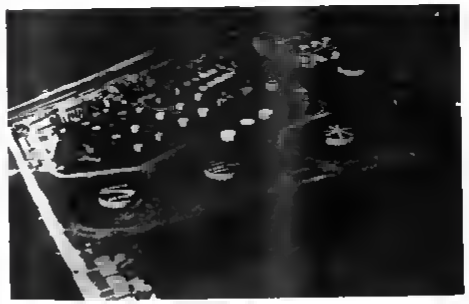
A Stromberg NA-T4 Carburetar which is standard equipment on a Wright Whirlwind engine.

this company is also a part of the exhibit. J. M. Miller of the Aviation Department and H. A. Hansen, manager of the Detroit factory branch, are in charge of the exhibit.

TEXAS-PACIFIC COAL AND OIL CO.

Ft. Worth, Texas

This exhibit which covers 200 sq. ft. of floor space is featured by the showing of a new type aero motor lubricating oils, sold under the registered trade mark AMLO. The exhibit shows ranger crude from the company's own producing wells in Central Texas, which is pure parrafin base crude produced from the Pennsylvanian formation and piped to the



Aerial view of the Fort Worth, Texas, refinery of the Texas-Pacific Coal and Oil Co.

refinery in Ft. Worth. The ranger pool was discovered in 1917, and a unique model shows the discovery well on the McCleskey lease in operation. This model is enclosed in a glass case. There is also shown the standard Thurma grades of lubricating oils produced at the Ft. Worth refinery from the high grade parrafin base crude

The exhibit is in charge of D. T. Evans, chief lubricating engineer, and F. R. Staley, chief chemist of the Texas-Pacific Coal and Oil Co

STRAUSS & BUEGELEISEN

Brooklyn, N. Y.

The exhibit which covers 100 sq. ft. of floor space is featured by the showing of 25 different styles of eye protection

for aviation. This company which has offices in San Francisco, Detroit and Hamilton, Ontario, has been making aviation goggles since 1917. Its Resistal lenses and goggles have already seen considerable service. The new styles include the Commodore, the United States Navy pilot goggle now being delivered on government contract and N.M.R., Resistals latest frame and cushion. Joseph Baegeleisen, who is head of the Detroit Sales office, is in charge of this exhibit.

W. HARRIS THURSTON

New York, N. Y.

In a display area covering 150 sq. ft. of floor space this company is exhibiting a large roll of "Dartmouth-Tex" grade A 36 in. mercerized cotton airplane cloth, rolls of pinked edge and straight edge aero tapes and also a bolt of Thurston's balloon cloth. There is also being shown some doped frames of Dartmouth-Tex made up through the courtesy of Berry Bros. A loud speaker constructed of Dartmouth-Tex is on exhibition as is also a model boat with sails made of the company's balloon cloth. This boat was loaned through the courtesy of Boucher Co., New York City. Various photographs and literature descriptive of the company's products are included in the exhibit. W. H. Thurston, Jr., and J. C Mathews are in charge.

E. S. TWINING & CO.

New York, N. Y.

The exhibit of this company which is included in 80 sq. ft. of floor space features the company's products, Flightex fabric and tape, which is being used by many of the leading aircraft manufacturers in the country. This cloth is a specially designed airplane fabric made from the best Egyptian cotton obtainable. It is carefully spun in the yarn and is mercerized to give maximum strength. The manufacturer states that Flightex fabric exceeds the requirements of the Army and Navy specifications and that the finished fabric adds greatly to the appearance of any plane. All of the planes on the trans-continental air mail routes are protected with Flightex fabric. Descriptive literature and samples of the company's product are obtainable at this booth. E. S. Twining and V. Dietz, Jr., are in charge of this exhibit.

UNIVERSITY OF DETROIT

Detroit, Mich

This exhibit which is educational in nature covers 750 sq. ft. of floor space. Here is shown one complete MS-1 float seaplane, (The construction consists of duralumin metal spars and rib, and tubular steel fuselage.) a twelve cylinder Liberty aircraft engine, a complete reaction dynometer and a Laurence three cylinder air-cooled engine and instrument test stand. There is also an instrument board illustrating the constructional feature of aircraft instruments and propeller mounted in three views illustrating propeller layout of cross sections and constructional features. The head of aeronautical engineering at the University of Detroit is Professor P. Altman.

UNIVERSITY OF MICHIGAN

Ann Arbor, Mich.

The feature of this exhibit which covers 50 sq. ft. of floor space is a working model of a wind tunnel designed by E. N. Failes, aeronautical engineer of the University of Michigan aeronautical staff. The tunnel is 18 in. in diameter and the propeller which is 20 in. from tip to tip is driven by a small ¾ hp electric motor. The aeronautical students at the University of Michigan have prepared the exhibit which also include small model airplanes, dirigibles and other types of aircraft. R. W. Miller, a graduate assistant of the aeronautical department, is in charge of the exhibit assisted by Charles Strang, a student at the University.

WESTINGHOUSE ELECTRIC & MFG. CO.

E. Pittsburgh, Pa.

This exhibit which covers 300 sq. ft. of floor space is featured by the showing of an airport lighting equipment and Micarta propellers, pulleys and fair leads. The airport lighting equipment includes an airport floodlight projector, boundary lights, approach lights, obstruction lights, hangar lights, and reflectors, a transformer, and a daylight lamp setter for the flood light projectors. The flood light projector gives an evenly diffused light of ample brilliance with the upward rays shut off at the horizontal. The Westinghouse airport installations are readily adaptable to any field regardless

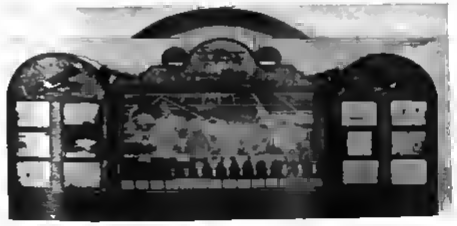
A Westinghouse Micarta propeller suitable for an OX-5 engine.

of size, shape or surface. Recently the Westinghouse Co. designed a new model Micarta propeller which is suitable for the OX-5 engine. This propeller which has successfully passed tests at Wright Field is extremely durable and light in weight and is of the detachable blade, adjustable pitch type. This model and the 200 hp. model which has been extensively used by the Army and Navy are unaffected by change in temperature or moisture. The Micarta pulleys on display are now standard equipment of practically every prominent aircraft manufactured in the country, according to a statement by the manufacturer. They are light in weight and have graphitized self lubricating bearing surfaces which reduce friction and wear to a minimum.

WESTINGHOUSE LAMP CO.

New York, N. Y.

The exhibit of this company covers 150 sq. ft. of floor space and is featured by a unique aviation lamp display which illustrates the various lamps used in aeronautical practice,



The Westinghouse aviation lamp display.

from the small compass lights located on the instrument board to the large 10 kw. lamps used for landing field illumination. The center piece carries a painting of a Class AAA landing field in front of which are 22 lamps with descriptive cards giving data for each lamp shown. The side transparency

boxes of this display show various views of the application of lamps in aeronautical practice. The airplanes are worked in relief. A plane mounted above the center piece is so constructed as to allow its propeller to revolve. This little propeller is driven by a small Universal motor. A rainbow in the back of the display is illuminated by means of a 100 watt lamp. The whole display is 10 ft. long and 7½ ft. high. The center piece is 22 in. deep and the transparent boxes are 10 in. deep. The weight of the display is approximately 395 lb. Together with the shipping case it weighs approximately 600 lb.

ALSO EXHIBITING

The following firms are also exhibiting at the Show: Overcashier Aircraft Mfg. Co., Detroit, Mich., two planes; Bausch Machine Tool Co., Springfield, Mass., accessories; Kalec and Forster, Detroit, Mich., aerial photography; The Texas Co., Detroit, Mich., lubricants; Hurd Mfg. Co., Detroit, Mich., one plane; Viking Aircraft Co. (formerly Chicago Aviation Co.) Chicago, Ill., one plane; S. F. Bowser & Co., Fort Wayne, Ind., fueling equipment; Imperial Brass Mfg. Co., Chicago, Ill., welding apparatus; McCord Radiator Mfg. Co., Detroit, Mich., fuel pumps and radiators; Michigan National Guard, 107th Aero Squadron, educational; Michigan Mutual Liability Co., Detroit, Mich., educational; Vacuum Oil Co., Detroit, Mich., lubricants; W. F. Williamson Advertising Service, Chicago, Ill., airport markers; Ypsilanti Reed Furniture Co., Ionia, Mich., reed chairs, and Lenert All-Metal Aircraft Co., Pentwater Mich., one plane.

The aeronautical publication exhibits include, AVIATION, New York, N. Y.; *Aero Digest*, New York, N. Y.; *Shipstream* Dayton, O.; *Air Transportation*, New York, N. Y.; *Air Travel News*, Detroit, Mich.; *Popular Aviation*, Chicago, Ill.; and *Associated Trade Press*, Chicago, Ill.

The Engine Division

Continued from page 971

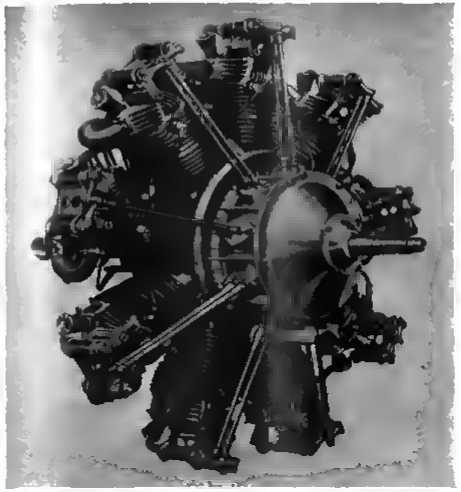
revolutions, and are now being used in the Navy three-purpose planes built by Glenn L. Martin. The 2500 geared engines have the same hp. rating and two of them are being installed in a Dornier Superwal plane in Germany which is being prepared for a trans-Atlantic flight this summer.

RYAN AERONAUTICAL CORP.

San Diego, Calif.

In a display area of 150 sq. ft. this company is exhibiting three Ryan-Siemens engines; one a 5 cylinder engine, another a 7 cylinder engine, and the third a 9 cylinder engine. The ratings are 70, 100 and 125 hp., respectively. The engines are air-cooled static radials and all three are of similar construction. The engines have a bore of 3 15/16 in., and stroke of 4 23/32 in., and a compression ratio of 5:6. The cylinders consist of an open steel journal, with aluminum alloy heads screwed on. They are provided with drop valves which are actuated by push rods and roller tappets. The crankshaft runs on ball and roller bearings. Four, six and eight secondary connecting rods respectively are connected to the head of the master rod, acting upon the crankshaft by way of two sturdy ball bearings. All are supplied with two Siemens magnetos and each cylinder with two Siemens spark plugs. The five cylinder engine is provided with one carburetor, the others with two. The arrangement of the nozzle holder on the carburetor permits of varying the adjustment even while the engine is running. Magnetos, carburetors, oil and oil pumps are fitted to the rear end cover in such a way as to be easily interchangeable and readily accessible. The engines are adapted for tractor or pusher propeller drive and normally run counter-clockwise (looking from the front).

The officials of the company state that engines running in a clockwise direction can be obtained. The engines are built by the Siemens-Halske Co. of Germany, and are imported to this country. They have been approved by the Department of Commerce for use in licensed aircraft and are rapidly becoming standard equipment for many planes in that power class. These engines were described in detail in the Oct. 24, 1927 issue of AVIATION.

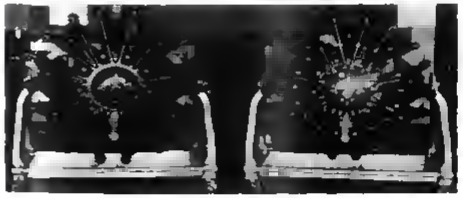


Front quarter view of the 9 cylinder Ryan-Siemens engine.

PRATT & WHITNEY AIRCRAFT CO.

Hartford, Conn.

The exhibit of this company which covers 400 sq. ft. of floor space is featured by the showing of both the Pratt & Whitney Wasp and Hornet engines, as well as a number of the parts representing distinctive features of the engines. The Wasp is a 9 cylinder radial air-cooled engine rated at 400 hp. at 1900 r.p.m. It is now a standard power plant for all new single and two place Navy planes for both carrier and catapult work. The Wasp without hub or starter weighs 660 lb., and the weight per rated hp. is 1.65. The bore is



Front views of the Pratt & Whitney "Hornet" (left) and "Wasp" engines.

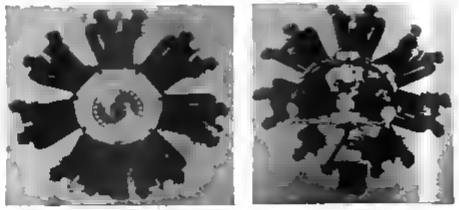
5⅝ in., and the stroke 5¾ in., and the compression ratio is 5 0. It is fitted with BG spark plugs, two Scintilla magnetos and one Stromberg carburetor. The shipping weight crated is 1150 lb

In 1927 the Wasp played a large part in the establishment of six world records by U. S. Navy planes. Four of these records were made with Vought Corsair (Wasp), and two in the Navy Apache (Wasp). Three of the first four records were high speed and the fourth was for altitude in a service plane. The last two records were landplane and seaplane altitude records with the same equipment. The Hornet is a nine cylinder radial air-cooled engine rated at 500 hp. at 1900 r.p.m. It was designed primarily for the weight carrying type of plane and is being installed for Naval purposes in single engine bombers. The Hornet was developed shortly after the Wasp and follows the Wasp design closely. Its weight dry without hub or starter is 750 lb, and the weight per rated hp. is 1.5. The bore is 6⅛ in., the stroke 6¾ in., and the compression ratio is 5 2. It has the same ignition and carburetor installations as the Wasp and the shipping weight crated is 1325 lb. It is believed that the Hornet for certain classes of work will replace the Wasp. Boeing Air Transport has already, because of excessive rates, put into service four of the Hornet engines in its standard mail planes. Within the last few months manufacturing rights for both the Wasp and the Hornet have been granted for Continental Europe to the Bavarian Motor Works of Munich, Germany. Further specifications of both of these engines will be found in the Commercial Engine Specification Table.

WARNER AIRCRAFT CORP.

Detroit, Mich.

This company is exhibiting in 200 sq ft. of floor space its new seven cylinder air-cooled radial engine rated at 110 hp. This is the first public showing of the engine. It is of conventional type, incorporates no radical features and was designed by W. O. Warner, vice pres., and chief engineer of the corporation. It has successfully passed the Department of Commerce 50 hour test and approval has been received from the Department. It presents a very clean appearance and all equipment is placed in the rear. It was designed with a view to minimizing the amount of time required for installation and it is comparatively easy to streamline the cowling. The cylinder barrel is of steel with an aluminum head.



Left, front view of the Warner engine. Right, rear view showing Scintilla ignition units that are easily accessible.

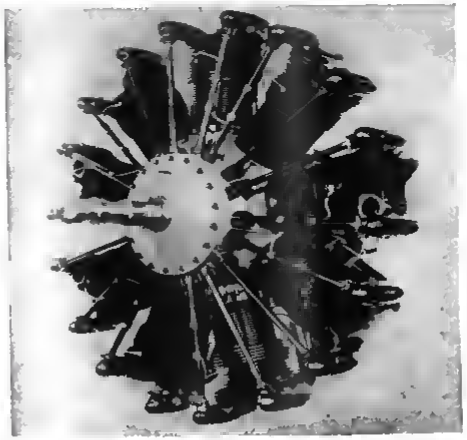
The bore is 4.25 in., and the stroke is 4.25 in. The push rod and rear end of rocker arms are enclosed while the front end of the rocker arms and springs are exposed. The engine is equipped with two Scintilla magnetos which are arranged in such a manner as to make them easily accessible. The engine can be readily mounted into a circular mounting of 17 in. diameter. Provision has been made for the adaptation of any standard commercial starter. The development of the Warner engine was commenced in October, 1926, and the first experimental engine was put through 125 hours of torque stand running including a 50 hour factory test during July, 1927, observing the rules of the standard 50 hour Army Air Service test. Following this test the engine was installed in a commercial plane formerly powered with an OX-5, for the purpose of securing flight test hours. This flight test has covered a period of several months under various climatic conditions during which time the engine has proved very reliable.

W. O Warner and W. J. Jarvis are in charge of this exhibit.

WRIGHT AERONAUTICAL CORP.

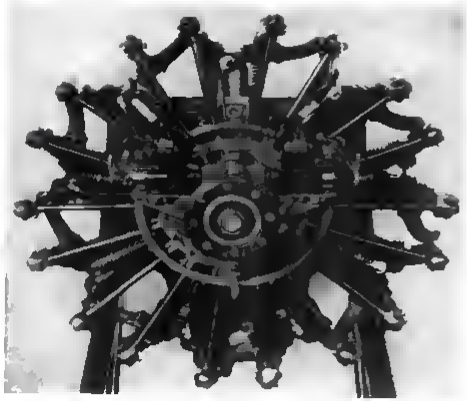
Paterson, N. J.

This exhibit covers 400 sq. ft. of floor space and is featured by a cut away model of the famous Wright Whirlwind J-5 engine in actual operation. The engine is driven by a belt on a small electric motor. The second feature of the exhibit is the Wright Cyclone R-1750 engine which is one of the last and most interesting developments in the radial engine field. The engine is a nine cylinder model of approximately 525 hp., and was designed especially for sustained heavy duty work in a high powered field where water-cooled engines are at present being utilized. The Cyclone is now being manufactured exclusively for the United States Navy, but it is possible that permission may be secured from the Government for the sale of this engine to civilians before the end of 1928. The engine has four cycles and the direction of propeller rotation is anti-clockwise. The guaranteed rated brake hp is 525 at 1900 r.p.m., at sea level. The weight dry without starter or hub is 700 lb., and the weight per rated hp. is 1.52 lb. The bore is 6 in., the stroke 6⅞ in., and the piston displacement is 1753 cu. in. The ignition is dual type Scintilla AG-9-G and the carburetor is Stromberg NAY-7-A. The shipping weight crated is 1530 lb. The cut away Whirlwind which is on exhibition is a 9 cylinder 4 cycle engine having anti-clockwise propeller rotation. The maximum brake hp. is 225 at 2000 r.p.m., at sea level. The weight dry with-



Front quarter view of the Wright "Cyclone" R-1750 engine.

ent starter or hnb is 500 lb., and the weight per rated hp is 2.5 lb. The bore is 4.5 in., the stroke is 5.5 in., and the compression ratio is 5.2. The piston displacement is 788 cu. in. The ignition is dual type Scintilla AG-9-D and the



Front view of the cut away model of the Wright Whirlwind engine.

carburetor is Stromberg NAT-4. The shipping weight crated is 1000 lb. Various illustrations of Wright products and their accomplishments together with miscellaneous literature are included in this exhibit which is in charge of John Rogers, sales representative of the company, assisted by other employees.

The Whirlwind J-5 engine was described in detail in AVIATION, Sept. 26, 1927.

Further specifications of both the Cyclone and the Wright Whirlwind J-5 will be found in the Commercial Engine Specification Table.

The Airplane Division

Continued from page 969

run truss construction to the rear of the baggage compartment and wire braced behind that point. The overall length is 36 ft. 8 in. The cabin is finished in mahogany and velour and is optionally equipped with five or six comfortable seats. It is ventilated and heated. The pilots cockpit which can seat one or two is of the enclosed type and partitioned off from the cabin with a communicating door. Control is single non-magnetic stick, accessible from both sides of the pilot's seat. There are dual rudder controls and steerable tail skid with brakes operating independently of each other. The weight empty with standard equipment is 2,800 lb. The pay load is 1,230 lb. The total useful load is 2,200 lb., and the total loaded weight 5,000 lb. The top speed at sea level is 138 m.p.h., the cruising speed is 118 m.p.h., and the landing speed is 40-42 m.p.h. The plane climbs 10,000 ft. in 10 min., and the service ceiling is 19,000 ft.

In addition to the Super-Universal the Atlantic Aircraft Corp. is displaying an interesting set of large photographs and models of the various types of Fokker planes. Among these are pictures of the new Fokker F-10, tri-engine job

powered with Pratt & Whitney Wasp engines. The F-10 which is being made for Western Air Express is designed to carry 12 passengers and two pilots and large quantities of baggage, freight and mail. The plane is stated to have a top speed of 148 m.p.h., and a climb of over 1,400 ft. per min. Capt. G. E. Haynes, formerly of the U. S. Army Air Service and later of the Department of Commerce, is in charge of the Atlantic Aircraft Corp. exhibit.

BERLINER AIRCRAFT CO., INC.

Alexander, W. Va.

In a display area of 1000 sq. ft., this company is exhibiting an OX-5 Berliner monoplane designed by Henry A. Berliner, president of the company. A similar plane is at the Ford Airport for demonstration use during the Show. The Berliner monoplane is a standard three place open cockpit plane which may be powered with either an OX-5 or a Wright Whirlwind engine. A five place semi-enclosed model convertible into a cabin job and also powered with the Wright Whirlwind is now under construction at the company's factory, and will be in production at an early date. The fuselage of the plane on exhibition is of welded chrome molybdenum steel tubing, covered with aluminum cowling and fabric. The wing is made in one piece, with box spars conforming to Army and Navy specifications, spruce ribs and fabric covering. The landing gear is clean and efficient, the shock absorbers being of the most advanced hydraulic spring type. Dual control is used and the standard finish is Aircraft Berryloid, cream and maroon. Other colors are optional. A baggage compartment is a part of the Whirlwind model. The span of this plane is 34 ft., the length is 25 ft., the chord 5 ft. 3 in., the height 8 ft., and the wing area 206 sq. ft.

Rear quarter view of the Berliner monoplane powered with an OX-5 engine.

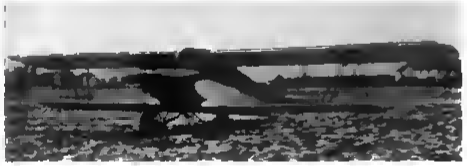
The OX-5 model weighs 1350 lb. empty, and the Whirlwind model weighs 1400 lb. empty. The high speed with full load of the OX-5 model is 100 m.p.h., landing speed is 41 m.p.h., and the cruising range is 400 mi. The Wright Whirlwind model has a high speed with full load at 138 m.p.h., a cruising speed of 110 m.p.h., landing speed of 44 m.p.h., and a cruising range of 450 mi. The equipment on the OX-5 model includes Hamilton or Hartzell wood propeller, tachometer, altimeter, air speed indicator, oil pressure gauge, temperature gauge, primer, ignition switch 26 x 4 tires and an adjustable stabilizer. The equipment of the other model includes Standard Steel propeller, Bendix wheel brakes, 30 x 5 tires, magneto compression tachometer, altimeter, air speed indicator, adjustable stabilizer, oil pressure gauge, temperature gauge, primer and switch.

BUHL AIRCRAFT CO.

Marysville, Mich.

This company is exhibiting two Buhl Airsedans and one polished fuselage of the same model. The company's exhibit covers 3,000 sq. ft. of floor space. The plane is a cabin type biplane powered with a Wright Whirlwind engine. It is designed to carry a pilot and four passengers. The cabin which

is clear is heated and contains a metal baggage and mail compartment. Two 35 gal. fuel tanks are carried, one on each side of the fuselage and in the upper wing. The polished model of the standard Airsedan fuselage is shown in skeleton. The weight empty is 2,100 lb., the wing span is 42 ft., the high



Front quarter view of the Buhl "Airsedan" powered with a Wright Whirlwind.

speed is 120 m.p.h., and the landing speed 42 m.p.h. The plane was built under the Department of Commerce Certificate of Airworthiness No. 12, approved for 1,000 lb. pay load. The plane is of welded steel fuselage construction with wood wings and included in the equipment of the plane are self-starter, compass, air speed indicator, navigation lights, tachometer, altimeter, clock, fire extinguisher, fuel and oil gauges, exhaust manifold with muffler, etc.

BELLANCA AIRCRAFT CORP.

Wilmington, Del.

The exhibit of this company which takes up 2,500 sq. ft. of floor space consists of one Bellanca monoplane, model CH and powered with a Wright Whirlwind J-5 engine. The plane is similar to that used by Chamberlin and Levine on their famous New York-Germany flight, and also to the plane owned by A. R. Martine in which Chamberlin and Williams attempted to establish a new endurance record. The only difference is that Model CH is fitted for the carrying of passengers. The two individual seats are richly upholstered as is also the wide seat in back. The two forward seats are separated with a fire extinguisher mounted between them. The fuselage is of welded steel tubing construction with a section behind the cabin being detachable by removing a pin in each longeron. The wings are of wood and covered with fabric. The landing gear is of the cantilever type with housing such that it can carry the plane temporary in case of failure. This model

Rear quarter view of the Whirlwind powered Bellanca monoplane.

has a useful load of 1,850 lb., and when loaded with sufficient fuel has a cruising radius of 800 mi., and allowing for the pilot, it has a pay load of 1,100 lb. With a useful load the maximum speed is 128 m.p.h., cruising speed 110 m.p.h., and the landing speed is 46 m.p.h. This plane was described in detail in the Jan. 23, 1928 issue of AVIATION. Further specifications will be found in the Commercial Landplane and Seaplane Specification Table.

CESSNA AIRCRAFT CORP.

Wichita, Kan.

This company is exhibiting in 1,500 sq. ft. of floor space one Cessna monoplane powered with a 120 hp. Anzani engine. A Cessna monoplane powered with a Wright Whirlwind engine is at the Ford Airport for demonstration purposes. The Anzani model is a closed cabin job and carries three people, two pilots and one passenger. The Wright Whirlwind model is a four-passenger job with a wide seat in back for two people. The seats are removable for mail or freight carrying and there is a standard compartment for baggage. The fuse-

Front quarter view of the Cessna three place cabin monoplane (120 hp. Anzani).

lage is of welded chrome molybdenum steel tubing construction. The wing is of full cantilever wood construction with plywood covering the box spars. The wings taper in both plan and section.

The Anzani model is stated to have a high speed of 120 m.p.h., a cruising speed of 110 m.p.h., and a landing speed of 45 m.p.h. The plane climbs at the rate of 1,000 f.p.m. Its weight empty is 1,250 lb. and with a disposable load of 750 lb., it has a gross weight of 2,000 lb. This plane was described in the March 5, 1928 issue of AVIATION.

DRIGGS AIRCRAFT CORP.

Lansing, Mich.

This company which is exhibiting in 900 sq. ft. of floor space is showing its standard 1928 model Driggs Dart II fitted with a 40 hp. Szekely engine. It is an open cockpit biplane with Warren truss interplane bracing. The fuselage which is of welded steel tubing construction weighs only 54 lb. The wings are of spruce beams with pressed duralumin ribs. The airfoil is R.A.F. 15, and the covering is Flightex, dual control is used. Tail surfaces are of welded steel tubing.

The Szekely engine with which this plane is powered is a three cylinder, fixed radial design rated at 40 hp. at 1800 r.p.m. It is known as the SR-3 and is the first of a line of

Front quarter view of the Driggs Dart powered with a three cylinder Anzani.

aircraft engines, being developed by the O. E. Szekely Corp., Holland, Mich., to be known as the Szekely SR series. The bore of the SR-3 is 4½ in., the stroke is 4¾ in. and the compression ratio is 4.8 to 1. It weighs 144 lb. dry and rated for shipping it weighs 205 lb. Tests have shown a gasoline consumption of .57 lb. per brake horsepower hour or approximately 3.8 gal. per hr.

The SR-3, which is in limited production, has all accessories,

except the oil pump, in the rear. Valve mechanism and intake manifolds are behind the cylinders, leaving the rocker arms as the only parts visible from the front. The exhaust port is in front of the cylinder, which is of nickel chromium alloy cast iron construction. The oil pump is mounted on the front of the crank case at the bottom and is easily removable for inspection. The pistons are of aluminum alloy and the valves are of steel fitted with two springs each. The valve mechanism was developed some time ago by the Szekely company. A single cam operates both valves through a system of individual rocker arms and push rods. Two Scintilla magnetos are furnished with each engine and are mounted side by side on a shelf cast integral with the rear crankcase cover. A Zenith carburetor is mounted below the engine. A more detailed description of this engine will appear in an early issue.

This plane fitted with a three cylinder Anzani engine was described in the July 11, 1927 issue of AVIATION. Further specifications will be found in the Commercial Landplane and Seaplane Specification Table.

J. H. EASTMAN

Detroit, Mich.

In this exhibit which is included in 900 sq. ft. of floor space is the Eastman flying boat, one of the few flying boats being displayed at the Show. It was designed and built by J. H. Eastman and is of the metal hull tractor type and powered with a 75 hp. Anzani engine. It seats two people side by side, and is stated to have exceptional stability under all conditions. The span of the upper wing is 34 ft., and the span of the lower wing is 22 ft. The length overall is 26 ft. The weight empty is stated to be 980 lb., and the useful load carried, 500 lb. The plane has a high speed of 75

Flight picture of the Eastman flying boat powered with a 75 hp. Anzani

m.p.h., a cruising speed of 60 m.p.h., and a landing speed of 42 m.p.h. The manufacturer states that the flying boat climbs at the rate of approximately 400 ft. per min., and that control is extremely positive at all speeds, and also that the boat shows no tendency to stall even in a vertical bank at low speed. With full load the Eastman flying boat requires only 15-17 sec. to take off. J. H. Eastman is in charge of this exhibit.

FAIRCHILD AIRPLANE MANUFACTURING CO.

Farmingdale, L. I., N. Y.

This exhibit, which is a part of the Fairchild Aviation Corp. display that covers 2000 sq. ft. of floor space, is featured by the showing of the Fairchild All-Purpose cabin monoplane, a five place plane powered with a Wright Whirlwind engine. The fuselage of this plane is welded steel tubing of four longeron construction. The wings are constructed of wood and are externally braced with V struts at each side.

The wings fold and are hinged about the rear spar attachment point. The All-Purpose cabin monoplane has also been powered with a Curtiss C-6 engine and a Pratt & Whitney Wasp engine. The wing span of the model on exhibition is 44 ft., length is 30 ft. 11 in., height is 9 ft. Fully loaded the plane weighs 3650 lb. The pay load is 845 lb., and the weight empty is 2150 lb. The top speed is 122 m.p.h., the landing speed 53 m.p.h. The service ceiling of the Fairchild All-Purpose

Side view of the Fairchild All-Purpose cabin monoplane (Wright Whirlwind).

cabin monoplane is 13,000 ft. The Department of Commerce type certificate No. 10 has been issued for the Wright Whirlwind model either as a landplane or seaplane, and Certificate No. 20 for the Wasp model either as a landplane or seaplane. This plane was described in detail in the Aug. 15, 1927 issue of AVIATION.

The whole Fairchild exhibit is in the charge of Richard Depew, sales manager, and J. Satterlee, engineer of the Fairchild Caminez Engine Corp. Graham B. Grosvenor, vice president of the Fairchild Aviation Corp., is also in Detroit.

GENERAL AIRCRAFT CORP.

Cincinnati, Ohio

The exhibit of this company covers 2500 sq. ft. of floor space. The plane being shown is a three place, open cockpit biplane powered with an OX-5 engine. The fuselage is constructed of welded steel tubing with a V door on the right side of the passenger cockpit. The wings are of the full cantilever type and constructed of laminated spruce spars and mahogany plywood ribs and covered with fabric. At the wing tips are N struts to take care of any wing flutter. The landing gear is of the split axle type and made of welded steel tubing. The shock absorber is mounted inside of the fuselage similar to the Curtiss P-1. The tail skid is a steel

Wind tunnel model of the "Nighthawk" manufactured by the General Aircraft Corp.

tube with a case hardened shoe and is steerable with the rudder bar. Tension springs are inserted in the skid cable controls. The ailerons and the tail surfaces are made of welded steel tubing and are fabric covered. Wire wheels with aluminum streamline discs are used. The span of the upper wing is 36 ft., and the span of the lower wing is 26 ft. The wing area of the upper wing is 162.5 sq. ft., and the wing area of the lower wing is 72.9 sq. ft. The plane is stated to have a top speed of 120 m.p.h., cruising speed of 102 m.p.h., and a landing speed of 35-40 m.p.h. The weight empty is 1250 lb. Conrad and John W. Dietz are in charge of this exhibit.

GILLIS AIRCRAFT CORP.

Battle Creek, Mich.

The exhibit of this company which covers 1500 sq ft. of floor space is featured by the first public showing of its product the "Crusader" cabin monoplane. The Crusader is an all-purpose, four place cabin plane, powered with a 125 hp Ryan-Siemens engine. It was designed by Prof Edward A. Stalker and Lawrence V. Kerber of the Department of Aeronautical Engineering of the University of Michigan. The cabin is entered on either side through roomy rectangular shaped door unobstructed by diagonal bracing. The rigidity and strength of the fuselage near the floor is maintained by a unique trussing which forms the column for the center wing section. Genuine leather is used in upholstering the cabin which has full visioned windows of unshatterable glass. Provision has been made for the carrying of 100 lb of baggage. Side-by-side dual wheel control is provided. A full Elgin instrument board is in plain view of the pilot, and the plane is fully equipped including wing and tail lights.

The fuselage is of welded seamless steel tubing and the tail and aileron sections are of the same material. Berry Bros. paint products are used throughout, the color of the fuselage being Nungesser green. The wings are of conventional type made of high grade specially treated airplane spruce and are wired for navigation lights. The ribs are of built up spruce and plywood. Square tie rods are used in internal bracing together with United States Government specification steel tubing for drag bracing. Flightex airplane covering is used on wings and fuselage. At 90 m.p.h. the Crusader has a cruising radius of 420 mi. The manufacturer states that the Crusader will climb 600 ft. per min., that the best angle of glide is 1 in 9.5 and the best angle of climb is 1 in 9. The service ceiling is stated to be 11,500 ft.

The landing gear is of the long stroke oleo split type and is fitted directly to the fuselage. The wheels are Bendix-Laddon equipped with 30 x 5 tires. Braking is accomplished through a swiveled lever which allows the braking force to be applied to any ratio between the two wheels and of any degree of magnitude up to maximum. The center of gravity is stated to be far enough back of the wheels to permit good braking action. The wing span of the Crusader is 32 ft. 9 in., and the overall length is 23 ft., and the height is 9 ft. The chord is 4 ft. and the wing area is 245 sq. ft. The gross weight of the plane fully loaded is 2400 lb. The high speed of the plane is stated to be 110 m.p.h., and the landing speed is 45 m.p.h. Further specifications of this plane will be found in the Landplane and Seaplane Specification Table.

HALPIN DEVELOPMENT Co.

Cincinnati, Ohio

The exhibit of this company which covers 1750 sq. ft. of floor space is featured by the showing of a new high wing all-metal monoplane known as the "Flamingo". It was designed and developed by Thomas E. Halpin, president of the company, and is powered with a Pratt & Whitney "Wasp" engine. The cabin seats a pilot and five passengers. Toilet and wash room facilities are provided as well as a mail and baggage compartment of 40 cu. ft. capacity. The fuselage is of welded seamless steel tubing construction throughout. The metal skin is fastened to light dural channels riveted to chips placed on the tubes. The main cabin is 44 in. wide, 60 in. high, and 108 in. long, and is fitted with upholstered reed chairs, secured to the floor. There is one wide door on the right side of the cabin and a door on the left side of the pilots' compartment. The cabin is finished in grey, duo-tone, embossed fibre board trimmed in red with aluminum strips around the windows and doors. It is also fitted with dome lights. The glass in the cabin windows is 1/8 in. plate and the glass surrounding the pilots' cockpit is unshatterable.

The wing is of the semi-thick high lift type having lift braces attached at 58 per cent. of the span. It is constructed entirely of duralumin and the spars are of I section and the flanges are built of extruded angles with a dural web set between them. The tail surfaces are of dural channel structure covered with standard .014 corrugated dural skin. The fin is adjustable on the ground and the stabilizer is adjusted by a screw operated from the pilots' compartment and is self locking in any position. All control surfaces are mounted on self-aligning ball bearings. The undercarriage is of the split axle type and fitted with standard Souzedde 30 x 5 wheels with standard brakes. The shock absorbing unit is Aerol. A tail wheel is also fitted to the plane. It is formed of sheet steel faired with aluminum and is mounted on an arm connected to shock chord. The stern post supports emergency skid. Controls are dual deperdussen with chain and sprocket to cables over Micarta pulleys to external horns on all surfaces. Rudder pedals are of the stirrup type.

Pioneer instruments are used and provision is also made for landing lights which will streamline into the wing tips. The overall length is 30 ft., the span 48 ft., the overall height 9½ ft., and the wing area 354 sq. ft. The fuel capacity is 150 gal. The top speed is stated to be 140 m.p.h., the cruising speed 120 m.p.h., and the landing speed 50 m.p.h.

HAMILTON METALPLANE CO.

Milwaukee, Wis.

This company is exhibiting in 4,400 sq. ft. of floor space one Hamilton all-metal closed cabin monoplane powered with a Pratt & Whitney Wasp engine. This plane, which is known as model H-21, is of duralumin construction with corrugated covering. The wings are almost full cantilever and have two short supporting struts on each side of the fuselage. The forward one goes to the point of attachment of the landing gear. The wings taper in both plan and thickness and three beams are used. The landing gear is of the split axle type, and Bendix brakes are standard equipment. The plane carries

A Hamilton Metalplane in flight at the 1927 National Air Races

from six to eight people. The cabin is upholstered, and the windows are trimmed with walnut. The fittings are of oxidized silver finish.

The Pratt & Whitney Wasp engine installed in model H-21 is fitted with a Hamilton metal propeller. The control is dual stick or wheel and push rods are used throughout. The type of shock absorber is oleo and air. The instrument equipment on this model, as on all models of Hamilton metal planes, includes tachometer, altimeter, air speed indicator, compass, fuel gauge, clock, oil pressure indicator, and oil temperature gauge.

The span of the plane on exhibit is 54 ft., the overall length is 33 ft. 7 in. and the height is 9 ft. The wing area is 392 sq. ft. Empty the plane weighs 2,495 lb., the useful load is 2,205 lb., and fully loaded the plane weighs 4,700 lb. The

top speed of model H-21 is 135 m.p.h., the cruising speed 115 m.p.h., and the landing speed 45 m.p.h. The fuel capacity is 140 gal. and the normal range in miles of this plane is 750.

This model, powered with a Wright Whirlwind engine, was described in the May 2, 1927 issue of AVIATION. Further information regarding its specifications will be found in the land plane and seaplane specification table.

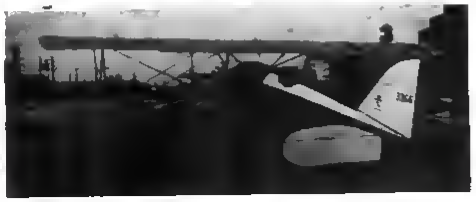
INTERNATIONAL AIRCRAFT CORP.

Cincinnati, Ohio

In a display area of 2,000 sq. ft. this company is exhibiting two of its planes, the International F-17 Sportsman and the International F-18 Air Coach. The F-17 is a three place open cockpit biplane powered with an OX-5 engine, and the F-18 is a six place plane powered with a Wright Whirlwind. In the F-18 four people are carried in a cabin in front and two, one of whom is the pilot, are carried in an open cockpit in the rear. Both planes are of wood construction. The fuselage has eight longerons with built-up bulkheads and plywood covered sides. The wings are constructed of box spars, ribs with plywood webs, set-in ailerons, and N type struts. A split type landing gear is used, also a steerable tail skid.

The cabin of the F-18 is luxuriously finished throughout in rich red mohair. A large glass panel door permits easy entrance and exit from the cabin. The windows are of non-breakable wired glass and the overhead windows may be opened for ventilation. Duplicating instruments are provided on the front panel in the cabin and include air speed indicator, clock, altimeter, etc. An adjustable heater permits comfortable traveling in cold weather. For the convenience of passengers, smoking trays, electric lighter, and a speaking tube to the pilot's compartment are provided. An overhead dome reading light is installed for night travel.

Side view of the International F-17 powered with an OX-5 engine



Rear quarter view of the International F-18 (Wright Whirlwind)

The top speed of the F-18 is 125 m.p.h., the landing speed 40 m.p.h., and the fuel capacity 106 gal. The span of the F-17 is 35 ft., the length 25 ft., and the height 9 ft. 6 in. Empty it weighs 1,350 lb. and fully loaded 2,589 lb. The top speed is 100 m.p.h. and the landing speed 35 m.p.h. The F-17 may be equipped with either the OX-5, Hisso, Anzani, Ryan-Siemens, Caminez, Wright Whirlwind, or other engines of similar type. The F-17 was described in the August 8, 1927 issue of AVIATION and the F-18 in the March 5, 1928 issue. Further specifications on both planes will be found in the commercial land plane and seaplane specification table.

H. A. Speer, vice president and sales manager of the company, and Perry V. Ogden, vice president in charge of production, are supervising the International exhibit.

KEYSTONE AIRCRAFT CORP.

Bristol, Pa.

The exhibit of this company, covering 300 sq. ft. of floor space consists of motion pictures, photographs, and models of its bombardment plane, the "Pirate", now in actual service of the Army Air Corps. This plane is one of the more recent types manufactured by the Keystone company for the Government. Twenty-five of them are now under construction and several have already been delivered. Carrying a load of bombs weighing more than a ton, as well as five flexible machine guns, the Keystone Pirate has a cruising radius of more than 500 mi. It is completely equipped with radio for sending and receiving and besides a pilot carries a bombardier, two gunners, a radio operator and an assistant pilot.

The fuselage is built up of chrome molybdenum steel tubing with all joints welded and forming a rigid truss without wire bracing. The tail surfaces are also of welded chrome molybdenum tubing, as are the wing stubs on which are carried the engine mounts. The wings are of box spars and wood rib construction and are fabric covered. The plane is powered with two 420 hp. Liberty engines equipped with electric starters. Metal propellers are used. The landing gear and tail skids are of the oleo type. The wheels are Seiuedde with brakes.

Front quarter view of the twin-engine bombardment plane, the Keystone "Pirate".

The span of the Pirate is 67 ft. 10 in. and the overall length is 45 ft. 9 in. The weight empty is 7,115 lb. and loaded 12,230 lb. A detailed description of the Keystone Pirate appeared in the March 26, 1928 issue of AVIATION. Specifications as to the commercial planes manufactured by the Keystone Aircraft Corp. will be found in the land plane and seaplane specification table.

The Keystone booth is in charge of Stanley W. Jacques, service representative. Edgar N. Gott, president of the company, and C. Talbot Porter, chief engineer, are also in Detroit.

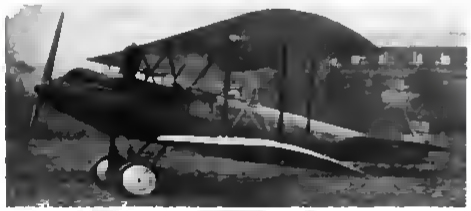
KREIDER-REISNER AIRCRAFT, INC.

Hagerstown, Md.

This company is exhibiting in 2,000 sq. ft. of floor space one model of the "Challenger". This plane is a three place open cockpit biplane powered with an OX-5 engine. Two people sit in the front cockpit and the pilot is seated in the rear. The fuselage is of welded steel tubing construction with no wire bracing giving a modified Warren truss. It is well streamlined and the engine is neatly cowled. The wings are

built up of routed spruce bars and spruce ribs of the Pratt truss type. Duralumin false ribs and trailing edges are used. The drag bracing is by compression members of box section and round drag wire bracing.

Numerous refinements are stated to have been made on the model now being exhibited. These include a new swiveling type tail skid, roomier front cockpit, a through axle type of



Front quarter view of the Kreider Reisner "Challenger" fitted with an OX 5

landing gear, and radiator shutters. The center section has been widened two inches, this gives slightly more slant to the center section and interplane struts. The plane has been issued Approved Type Certificate No. 19.

The span of the plane on exhibition is 30 ft. 1 in., the overall length is 23 ft. 9 in., and the height is 9 ft. 4 in. The weight empty is 1,236 lb. and the weight loaded 2,000 lb. The top speed of the Challenger is 102 m.p.h. and the landing speed 40 m.p.h. The plane was described in the October 3, 1927 issue of AVIATION. Further specifications will be found in the land plane and seaplane specification table.

IRELAND AIRCRAFT, INC.

Garden City, L. I., N. Y.

This company is exhibiting one Ireland Neptune amphibian in 2,500 sq. ft. of floor space. The Neptune is a five place closed cabin Wright Whirlwind powered pusher biplane. The model on exhibition differs from the first experimental model in that the hull is entirely of metal and the cockpits are covered over. This hull is believed to be the first ever constructed with welded steel tubing for its internal structure. It is built up like a fuselage with four longerons and tubular cross bracing. Some of the bottom bulkheads are of pressed duralumin sheet and the covering of the bottom and

Front quarter view of the first model of the Ireland "Neptune" amphibian

sides is of "Alclad", a corrosion resisting alloy manufactured by the Aluminum Co. of America. The cockpits are covered over with a transparent covering that is streamlined to fair in with the hull. The seats are upholstered with "Russeloid".

The controls are the same as in the experimental model being dual side by side, "Dep". The control is in front with landing gear retraction lever between the seats. Three passengers are carried in the rear seat with the pilot and the fourth passenger in the front seat. A glass enclosed instrument board layout manufactured by the Elgin Watch Co. is used. The experimental model of the Neptune was described in the Nov. 28, 1927, issue of AVIATION. The high speed of the experimental model is 95 m.p.h., cruising speed 85 m.p.h., and the landing speed 46 m.p.h.

Further specifications of the Ireland Neptune amphibian are to be found in the Commercial Airplane and Seaplane Specifications Table.

E. M. LAIRD AIRPLANE CO.

Chicago, Ill.

In a display area covering 2500 sq. ft., this company is exhibiting one Laird biplane fitted as a landplane and another fitted as a seaplane, each of which is powered with a single Wright Whirlwind engine. The Laird Whirlwind is an open cockpit, three place single bay biplane of conventional yet very light construction. The fuselage is of duralumin tubing with steel sleeve fittings at each joint, and is wire braced with cable in front and hard wire behind the pilots' seat, which is in the rear. The engine mount is a machined steel ring held in place by tubes. The engine which is a Whirlwind with exhaust ring behind is well cowled, and there

Front quarter view of the Laird biplane powered with a Wright Whirlwind

is one fuel tank behind the engine and another in the center section of the upper wing. The wings consist of laminated spruce spars with trussed ribs reinforced with plywood webs. The compression ribs are of solid spruce. No. 8 wire is used for internal bracing. There are no bolts running through the spar. Arens control is used for ailerons and engine controls. The weight empty of the Laird Whirlwind is 1500 lb., and loaded it weighs 2350 lb. It has a top speed of 130 m.p.h., a landing speed of 40 m.p.h., and climbs 10,000 ft. in 10 min., and has a range of 600 mi. This plane was described in detail in the July 26, 1926 issue of AVIATION. Further specifications will be found in the Commercial Landplane and Seaplane Specification Table.

LOCKHEED AIRCRAFT CO.

Los Angeles, Calif.

The feature of this exhibit is the showing of the Lockheed "Air Express" powered with a Pratt & Whitney Wasp engine. This company also makes the Lockheed "Vega" powered with a Wright Whirlwind. The plane on exhibition is an internally braced monoplane of wood construction. The fuselage is of monocoque construction made by the process patented by Malcolm Loughhead. The fuselage which is an almost perfect streamlined shape is built in sections and glued together in a huge concrete mold under 150 tons pressure. The wing is of full cantilever design with two spruce box spars and girder type ribs. The covering is of plywood and the wings have been tested to 1400 lb. without injury. The split type landing gear is fitted with Lockheed brakes. The plane is of a closed cabin type and seats from four to seven people.

The span is 41 ft., the length 25 ft., and the wing area

275 sq. ft. Powered with a Wright Whirlwind the plane weighs 1650 lb. empty, and 3200 lb. loaded. Powered with a Wasp it weighs 1850 lb. empty, and 3645 lb. loaded. The Whirlwind plane has a top speed of 135 m.p.h., and a landing speed of 50 m.p.h., whereas the Wasp plane has a high

Front quarter view of a Lockheed "Vega" powered with a Whirlwind

speed of 165 m.p.h., and a landing speed of 55 m.p.h. This plane was described in detail in the Oct. 22, 1927, issue of AVIATION. Further specifications will be found in the Commercial Airplane and Seaplane Specification Table.

LOENING AERONAUTICAL ENGINEERING CORP.

New York, N. Y.

The feature of this exhibit which covers 3,000 sq. ft. of floor space is the new Loening Cabin Amphibian, powered with a "Wasp" engine. This plane was developed directly from the Government OL-8 type of amphibian. The only material change is the modification for the cabin at the rear of the wing seating four to six passengers and inclusive of a small lavatory. The cabin is fitted up with swivel arm chairs, electric lights, triplex windows, baggage holds, magazine racks, buffet rack and smoking equipment. One of the most interesting features of the cabin arrangement is that, due to the widening at the back of the pilot's cockpit there is obtained a direct forward visibility for the passengers despite the fact that the plane is of the normal biplane type. The cabin is over 6 ft. long and 4 ft. wide, and has 61 in.

The Loening Cabin Amphibian in flight.

head room. It is upholstered in natural saddle leather trimmed with buffed cloth and a buff carpet, yet there is no wilful waste in weight or sacrifice of easy access for serviceability. The Pratt & Whitney Wasp engine is mounted at the nose with exactly the same installation as the Government OL-8 am-

phibian, and drives a 9 ft., three bladed Standard Steel propeller and is installed with all the latest equipment, such as automatic fire extinguisher, oil strainer, electric inertia starter and generator.

Another feature of the Loening Cabin Amphibian is the muffler. A very large size manifold gives ample expansion space for the gases that collect in the exhaust and carries them over the top wing where they are delivered to the Ventura type muffler, which has been developed by the Loening engineers. This consists of a large single expansion and whirling chamber instead of smaller ones on each side.

The wing structure is of the normal staggered biplane type. The span is 45 ft., the chord 6 ft., and the wing area is 500 sq. ft. The wing section is the Loening 10-A type. The weight of the Loening Cabin Amphibian empty is 3400 lb.,

Side view of the Loening Cabin Amphibian powered with a "Wasp" engine.

inclusive of the following equipment: muffler, heater, electric inertia starter, generator, navigation lights, batteries, Standard Steel propeller, complete cabin furnishings, triplex glass, lights, toilet, baggage holds, anchor and line of instruments including compass and turn indicator, double fuel pump system, fire extinguisher, wheel brakes (optional), etc. The total weight of the plane in the air is 5,400 lb. The fuel load is 140 gal. gasoline, 12 gal. of oil. The pay load is 1,200 lb.

Further data regarding this plane will be found in the Commercial Airplane and Seaplane Specification Table. The Loening Cabin Amphibian was described in detail in AVIATION, April 9, 1928.

B. F. MAHONEY AIRCRAFT CO.

St. Louis, Mo.

The exhibit of this company, manufacturer of the famous "Spirit of St. Louis", covers 1,300 sq. ft. of floor space and is featured by the showing for the first time of the 1928 "Brougham." The plane is stated to have many structural improvements and refinements not found in the Brougham of last year. Included in these improvements are 32 x 6 tires, heavy duty wheels and wheel brakes, streamlined Gruss Air Springs in place of the old type elastic shock cords, and a large cabin heater operating from the exhaust stacks. The wheel brake cables are run in special conduit from the wheels to the rudder pedals, are streamlined into the landing carriage and are operated in conjunction with the rudder. The plane an exhibit has a new type of tail skid. The shock load on the tail skid is cushioned through rubber discs, thereby eliminating broken shock cord. Larger tail surfaces and two full width sedan type doors are other improvements on the plane.

The instruments are mounted on a dark panel board and include air speed indicator, turn and bank indicator, compass,

altimeter, tachometer, oil pressure and temperature gauges, gasoline gauges, dashlights, navigation light switches, and Lunkenheimer primer and choke. Below the board on a dark aluminum plate are the gasoline and oil line pet-cocks, and below these are brake pedals, cabin heater regulator, and Pyrene.

The pilot's seat is adjustable up and down and swings back allowing immediate access. The windows on each side of the

Side view of the new 1928 Brougham powered with a Wright Whirlwind

pilot are adjustable up and down, and forward is a windshield wiper. The cabin, which accommodates four passengers, is upholstered in velour with leather cushions and thick rugs. Oak trim windows slide open or closed and may be locked in any position from the inside. The baggage compartment is accessible while in flight and holds 150 lb. of baggage. The silver finish of the Brougham has been retained and the aluminum work is natural finish scroll with varnish.

The span of the plane on exhibit is 42 ft., the overall length 27 ft. 9 in., and the overall height 9 ft. 10 in. Empty the plane weighs 1,870 lb. and fully loaded 3,300 lb. The top speed is 126 m.p.h., the landing speed 49 m.p.h., and the service ceiling 16,000 ft. Further specifications on this plane will be found in the landplane and seaplane specification table.

MOHAWK AIRCRAFT CORP.

Minneapolis, Minn.

The exhibit of this company covers 1500 sq. ft. of floor space and is featured by the showing of the Mohawk "Pinto", a two place (staggered seats) open cockpit, full cantilever, low wing monoplane powered with an 80 hp. Anzani engine. The

Side view of the Mohawk "Pinto" powered with an 80 hp Anzani engine

fuselage is of welded steel tube construction in the form of a Warren truss with no wire bracing. The wing which tapers in plan and chord is constructed of box spars, with two-ply mahogany bulkheads every 14 in. The spars are not parallel but converge toward the wing tip. The ribs are built up

of spruce cap strips and mahogany ply web. The ailerons are controlled by torque tubes. The landing gear is supported to the wing. The seating arrangement is such that the pilot is on the left and the passenger on the right and slightly to the rear. There is a baggage compartment behind the pilot. The span of the Pinto is 30 ft. 6 in., the length 20 ft. 2 in., the height overall 6 ft. 3 in., and the wing area 124 sq. ft. Powered with an Air-Cat engine the plane weighs 700 lb. empty and 1200 lb. loaded. The top speed is 110 m.p.h., the cruising speed 90 m.p.h., and the landing speed 35 m.p.h. The former model of this plane was described in the Nov. 21, 1927 issue of AVIATION and the changes incorporated in the Anzani model were described in the March 26, 1928 issue of AVIATION.

Further specifications will be found in the Commercial Landplane and Seaplane Specification Table.

MONO AIRCRAFT, INC.

Moline, Ill.

This company which was formerly known as Central States Aero Corp. of Davenport, Iowa, is exhibiting three "Monocoupes" in a display area of 1800 ft. One is powered with an Anzani engine, the other a Cirrus engine, and the third a Velie engine. The Monocoupe is a two place closed cabin externally braced high wing monoplane fitted with side-by-side dual control. The fuselage is of welded steel tubing construction and the wings are of wood, rectangular in plan with rounded corners, spruce ronted I spars and trussed ribs. Fabric covering is used. The engine mount is of chrome molybdenum and the gasoline is carried in wing tanks.

The Velie engine, on display in the Monocoupe, is a new development by the Velie Motors Corp. of Moline, Ill. It is a five cylinder radial, air-cooled engine rated at 70 hp. at 1800 r.p.m. However, it is stated by the manufacturer to develop 80 hp. at 2000 r.p.m. The engine is of conventional design with all accessories in the rear. It has five static cylinders of nickel steel alloy with integral fins and screwed-on heads of aluminum alloy. Each cylinder has one inlet and one exhaust valve seated on an aluminum bronze. Two AC spark plugs per cylinder are provided. Dual ignition is furnished by two five-cylinder Scintilla magnetos located behind

Front quarter view of the Monocoupe fitted with a 70 hp Velie engine

the engine mounted on the gear case. This also carries the tachometer drive and oil pump. The oil pump assembly consists of two pumps, one supplying oil pressure to the engine bearings and the other for scavenging.

Standard equipment also includes a Zenith carburetor mounted below the engine and fitted with a mixture control. This is operated from the cockpit to insure good carburetion at all altitudes. The engine is designed to mount an Eclipse electric starter which, complete with battery, adds only 40 lb. to the weight of the engine. The engine weighs 210 lb. dry without hub or starter. Thus it weighs 2.63 lb. per rated hp. The bore is 4½ in. and stroke 3¾ in. The compression ratio is 5.2 and displacement 250.6 cu. in.

The Monocoupe span is 30 ft.—the length 19 ft. 9 in., and

the wing area is 150 sq. ft. The top speed is 102 m.p.h. and the landing speed 48 m.p.h. This plane fitted with an Air-Cat engine was described in the Oct. 10, 1927, issue of AVIATION. Further specifications on this plane will be found in the Commercial Landplane and Seaplane Specification Table.

NATIONAL AIRWAYS SYSTEM

Lomax, Ill.

In a display area of 1500 sq. ft. this company is exhibiting two of its standard type Air Kings, one powered with an OX-5 engine and the other with a 10 cylinder, 120 hp. Anzani engine. The Air King is a three place open cockpit, single bay biplane with the pilot seated in the rear. The fuselage is of welded steel type construction. The engine is mounted on a steel frame and the radiator, which is horizontal, is mounted above the center section. The upper and lower wings on each side are interchangeable. The wing is made up of spruce box spars and spruce and ash ribs, except the tip which is of steel tubing. The plane is fitted with an adjustable stabilizer and there is a split type landing gear with rubber cord in tension. The span overall is 34 ft. 1 in., the length is 25 ft. 6 in., and the height 9 ft. According to the manufacturer the plane has a top speed of 103 m.p.h. and a landing speed of 35 m.p.h. This plane was described in detail in the Sept. 12, 1927 issue of AVIATION.

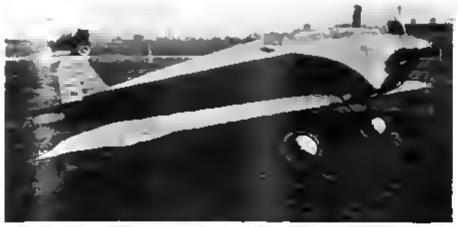
Close up rear quarter view of an Air-King fitted with an OX-5 engine.

Further specifications regarding the Air King will be found in the Commercial Airplane and Seaplane Table. Dr. John D. Reardon is in charge of the exhibit.

NILES AIRCRAFT CORP.

Niles, Mich.

This company is exhibiting one plane known as the Williams monoplane. It is a single place open cockpit job, powered with a 30 hp. Anzani engine. The wing which is set low is of full cantilever wood construction. The spars are built up of spruce cap strips and mahogany plywood sides in the form of a box spar. The ribs are built up of spruce strips into a Warren truss with birch plywood gussets at the joints. The drag bracing consists of welded steel tubes for compression struts with piano wire diagonal bracing. The airfoil used is a Gottingen 387. The fuselage which is rectangular in shape is of welded steel tubing. No wire bracing is used as the entire structure is built up in the form of a Warren truss. One of the features of this plane is the tail skid which is a wheel mounted in the rudder and fitted with a brake. The wheel is of the wire type with a brake band mounted at its rim. The landing gear is of the divided type with a compression member supported from the wing spar. In designing this plane considerable assistance was rendered by the senior aeronautical students at the University of Detroit. The model on exhibition is powered with a 30 hp. Anzani engine, but it is stated that future planes will be of two place side-by-side design, and will be powered with single 40-45 hp. Szekely engines. The span of the plane on exhibition is 26 ft., the length is 18 ft., and the wing area 108 sq. ft. According to the manufacturer the top speed is 85 m.p.h., and the landing speed 30 m.p.h. This plane was described in detail in the April 2, 1928, issue of AVIATION. Further specifications will be found in the Commercial Airplane and Seaplane Specification Table.



Front quarter view of the Williams monoplane powered with a 30 hp. Anzani.

PITCAIRN AVIATION, INC.

Philadelphia, Pa.

In a display area of 1500 sq. ft. of floor space this company is exhibiting the Pitcairn Sport Mailwing, an open cockpit biplane powered with a Wright Whirlwind engine. The passenger cockpit is upholstered over plywood on all sides and can accommodate two passengers. The baggage compartment is built into the fuselage directly behind the pilots' cockpit making the plane ideal for touring. The fuselage longerons are of square section steel tubing to which are butt-welded all cross members and stays. The wings are of conventional wood construction and are fabric covered. The wing section which is Pitcairn No. 1 is a general high performance section with characteristics eliminating the tendency to fall into a stall suddenly when in flight at minimum speed. The section consists of deep spars both front and rear. Ailerons are fitted to the lower wings only. Because of the wing tip and tail navigation lights the wing structure is bonded throughout giving perfect electrical contact between all metal fittings.

Side view of the Pitcairn Mailwing powered with a Whirlwind.

The tail group is constructed throughout of welded steel tubing using square section tubing for the main hinged spar of the stabilizer. The landing gear which is of the split axle type has an extremely wide tread of 76 in., and is made of special heat treated molybdenum and is fully streamlined.

With normal full load the plane has a high speed of 133 m.p.h., cruising speed of 112 m.p.h., and a landing speed of 50 m.p.h. The gasoline capacity is 56 gal., which allows a cruising range of 500 mi. The overall span of the upper wing is 33 ft., the overall span of the lower wing is 30 ft. The overall length is 21 ft. 10½ in., and the height is 9 ft. Further specifications of this plane will be found in the Commercial Landplane and Seaplane Specification Table.

PARAMOUNT AIRCRAFT CO.

Saginaw, Mich.

In a display area of 1,350 sq. ft. this company is exhibiting a closed cabin, four passenger biplane designed around a Warner seven cylinder radial air-cooled engine of 110 hp. The designer of this plane is Walter J. Carr, former chief pilot of the Warner Aircraft Co. The plane is stated to have splendid performance in the air and unobstructed view has been secured, as well as a very large passenger or carrying space. The plane on exhibit, which is a standard model, is upholstered and equipped with an Elgin unit control board, heater, etc. Two wicker chairs and one wicker settee give a comfortable seating arrangement. The span is 33 ft. J. E. Belise, president of the company, is in charge of the Paramount exhibit.

PHEASANT AIRCRAFT CORP.

Memphis, Mo.

The exhibit of this company which covers 3000 sq. ft. of floor space is featured by the showing of the company's OX-5 model equipped with streamline wires. This plane is a three place open cockpit job, and stress analysis has been approved by the Department of Commerce for the OX-5 and Anzani models. The fuselage is of welded steel tubing construction. The front cockpit which holds two has a door on one side. Tubes are used for cross bracing in the form of a modified Warren truss. The wing is of wood construction with routed spars and built up ribs. Solid compression struts are used. The wings are fabric covered and the upper one is Clark Y section, and the lower wing is Aeromarine section. The tail surfaces are of welded steel tube construction and are cov-

Rear quarter view of the Pheasant biplane fitted with an OX-5 engine.

ered with fabric. The stabilizer is adjustable from the cockpit and all control surfaces except the rudder are controlled by push rods. The span of the upper wing of the OX-5 Pheasant is 31 ft., and the span of the lower wing is 29 ft. The length is 23 ft. 5 in., and the height is 9 ft. Empty the plane weighs 1297 lb., and fully loaded it weighs 2082 lb. This plane fitted with an OX-5 engine was described in detail in the Sept. 19, 1927 issue of AVIATION.

Further specifications will be found in the Commercial Landplane and Seaplane Specifications Table.

SIKORSKY MFG. CO.

Long Island, N. Y.

As the plane being exhibited by this company is too large to enable it being set up in Convention Hall, it has been placed on display at the Detroit Yacht Club. The Sikorsky

booth contains pictures of Sikorsky products and descriptive literature.

The plane at the Detroit Yacht Club is a Sikorsky amphibian, type S-36. It is a closed cabin model powered with two Wright Whirlwind engines, and resembles the Sikorsky amphibian recently delivered to the Navy, and also those in service in South America. It has an outrigged tail supported by a boom from the upper wing and struts from the boat hull,

The Sikorsky S-36 taxiing on the water.

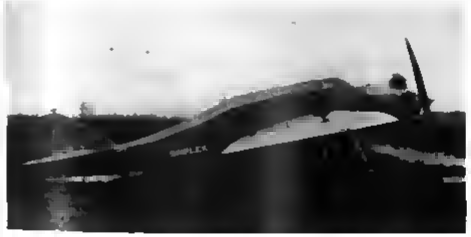
and it is fitted with a retractable landing gear and can be landed on land or water. The hull is of composite construction, having a wood frame with metal fittings and metal covering.

The wing structure is duralumin covered with fabric. The upper wing which is much larger than the lower has a span of 70 ft. 6 in. The overall length is 34 ft., the high speed is 110 m.p.h. and the landing speed is 51 m.p.h. This plane was described in detail in the Sept. 5, 1927 issue of AVIATION. Further data will be found in the Commercial Landplane and Seaplane Specification Table.

SIMPLEX AIRCRAFT CORP.

Defiance, Ohio

The exhibit of this company covers 2400 sq. ft. of floor space and consists of two models of Red Arrow monoplanes. One is a two place open cockpit job powered with a 100 hp. Kinner engine; the other a three place cabin powered with the same type of engine. Both planes are externally braced monoplanes with struts supported from a truss below the fuselage. This truss also supports the landing gear. The



Side view of the Simplex closed cabin plane fitted with a 100 hp. Kinner engine.

wing is set at the thrust line and is made of wood and fabric covered. The fuselage is of welded steel tubing, and dual side-by-side control is provided. In the three place model there is a third seat in the rear. The closed cabin model has doors on both sides. The tanks are behind the engine. The span is 33 ft. 4 in., the overall length 20 ft., and the height is 6 ft. 10 in. Empty the plane weighs 750 lb., and loaded

it weighs 1500 lb. The top speed is stated to be 130 m.p.h, and the landing speed 40 m.p.h. Further specifications on these planes will be found in the Commercial Landplane and Seaplane Specification Table. These planes were described in detail in the March 20, 1928, issue of AVIATION.

STINSON SCHOOL OF AVIATION
Detroit, Mich.

The exhibit of this company covers 1500 sq. ft. of floor space and consists of miscellaneous literature, etc., that describes the activities, aims, purposes, and policies of the Stinson School of Aviation, also the plane known as the J.B.S. "Aircoupe" which was designed by Jack B. Stinson for use in connection with his school. The plane is a closed cabin monoplane powered with a 90 hp LeBond engine. It is ex

Front quarter view of the J.B.S. "Aircoupe"

ternally braced with a steel tube fuselage and wing set above which is of wood with spruce spars. It is fitted with dual side-by-side control, also wheel brakes, electric starter, adjustable stabilizer, steel tube controls and compression rubber shock absorber. The school course which is under Mr. Stinson's personal supervision and guidance consists briefly of 26 ground lessons and 30 lessons in the air.

STEARMAN AIRCRAFT CO.
Wichita, Kan.

The exhibit of this company, covering 1,500 sq. ft. of floor space, is featured by the display of its standard Wright Whirlwind model, C-2B. Another model, C-2K, powered with a Ryan-Siemens engine, is at the Ford Airport for demonstration purposes. The plane on exhibit is a three place open cockpit biplane, seating two people in front and a pilot in the rear. The control is of the dual type but the front

Side view of the Stearman biplane powered with a Wright Whirlwind.

cockpit controls may be removed if necessary. The fuselage is of chrome molybdenum steel tubing, forming a modified Pratt truss. All Stearman models are the same aft of the fire wall regardless of engine installation.

The usual instruments are installed and also a Pioneer air speed indicator and compass. A throttle is provided at each side of the cockpit. The wings are of wood construction and have routed spruce I beams and built-up ribs. The leading edge is reinforced with sheet dural. Differential aileron control is used. The tail surfaces are of steel tubing construction and the landing gear is of the split axle type, with Hayes wheels with brakes.

The span of the plane is 35 ft., the length is 23 ft. 2 in., the height is 9 ft. 2½ in., and the wing area is 297 sq. ft. Fitted with a Wright Whirlwind the weight loaded is 2,450 lb. and fitted with a Ryan-Siemens it is 2,150 lb. The high speed of the Wright Whirlwind model is 130 m.p.h., the landing speed 41 m.p.h., and the range in miles 621. In the case of the Ryan-Siemens model, the high speed is 110 m.p.h., the landing speed 38 m.p.h., and the range in miles 500. Further specifications on this plane, model C-2B, will be found in the land plane and seaplane specification table.

STINSON AIRCRAFT CORP.
Northville, Mich.

This exhibit which covers 5,000 sq. ft. of floor space is featured by the showing of four Stinson-Detroiter planes. The planes being exhibited are a Standard Stinson-Detroiter monoplane seating six passengers, a Stinson-Detroiter biplane seating a pilot and four passengers, the Stinson monoplane, Pride of Detroit, which won the 1927 Ford Tour and was later used by Brock and Schlee in their famous Newfoundland-Tokio flight, and a new three place cabin monoplane powered

The Stinson-Detroiter monoplane in which Eddie Stinson and George Haldeman set a new endurance record of 53 hr. 36 min. 30 sec.

with a seven cylinder 120 hp., Warner engine. This plane is known as the Stinson-Detroiter "Junior" Monoplane, and this is the first showing of the plane.

The Standard Stinson monoplane being exhibited carries such standard equipment as Standard Steel propeller, side-by-side controls, brakes, starter, heaters, baggage compartment, Oleo and spring landing gear and instruments. It is also equipped with toilet and washstand and is beautifully finished both inside and out. The Stinson-Detroiter monoplane has a wing span of 45 ft. 10 in., weighs 1970 lb. empty, has a high speed of 128 m.p.h., and a cruising speed of 105 m.p.h. It may be operated either on wheels, pontoons, or skis. It was a plane of this type that Eddie Stinson and George Haldeman used when they set a new world's endurance flight record of 53 hr. 36 min. 30 sec. at Jacksonville, Fla., March 28-30. On a previous attempt at the record they took their plane off the ground with a useful load of 4250 lb., which is said to be a world's record for planes equipped with a Wright Whirlwind engine. On the record breaking flight the plane carried 558 gal. of gasoline, 19 gal. of oil, etc., making the total weight of the plane approximately 6,060 lb.

The Stinson-Detroiter Biplane which seats a pilot and four passengers is identical with other Stinson biplanes which have been in operation on the Northwest Airways between Chicago-St. Paul and Minneapolis where 800 mi. per day have been flown since October, 1926. This type of plane was used

by Capt. George W. Wilkins in his explorations in the Arctic. The Stinson Junior is equipped with dual side-by-side controls, oleo and spring landing gear, starter, brakes, heaters, instruments and other features of the small quality plane. It has a span of 41 ft. 4 in., a chord of 75 in., an overall length of 26 ft. 1 in., a height of 7 ft. 3 in., and a wing area of 228 sq. ft. The wing section is Clark Y; the wheels are 28 x 4 and the gasoline capacity is 40 gal. Empty the plane weighs 1410 lb., and the useful load is 800 lb. The high speed of the plane is stated to be 110 m.p.h., the cruising speed 95 m.p.h., and the landing speed 45 m.p.h.

STOUT METAL AIRPLANE CO.
(Division Ford Motor Co.)
Dearborn, Mich.

The Stout exhibit which takes up 8,000 sq. ft., of floor space is characterized by the strikingly contrasting types of monoplanes shown. Alongside Series 4-AT-17, the last tri-engined all-metal monoplane to come off the Ford assembly line before the show opened, is placed an antiquated little Bleriot monoplane of the vintage of 1909. This plane is one of the recent additions to Henry Ford's museum collection. The Josephine Ford, the tri-engined Fokker monoplane in which Commander Byrd flew over the North Pole is also on display.

The Bleriot plane which has a wing spread of only about 20 ft. takes one back to the days of the lattice-work fuselage and fragile wing construction. It is the only one of its series in the United States, and while not having been flown recently, it is complete and in flying condition.

The main feature of the exhibit is the Ford Model 4-AT-17. This plane, which is the seventeenth tri-engined monoplane to be built by the Airplane Division of the Ford Company,

Front quarter view of the Ford-Stout all-metal monoplane Series 4-AT-17 (three Wright Whirlwinds)

has been sold to the Standard Oil Co. of Calif., for use by the officials of that company on the Pacific Coast. It has a capacity of 10 to 12 passengers and is of the closed cabin type. A new type of wicker chair with a high narrow back designed to give the maximum of passenger comfort is installed in the plane. This chair permits a complete relaxation, the back being sufficiently high to provide a headrest. It is upholstered in bright colors with deep comfortable cushions. The plane which is typical of those produced today by the Ford Company has a wing spread of 74 ft., an overall length of 49 ft. 10 in., and is powered with three Wright Whirlwind engines developing 215 hp. at 1,800 r.p.m. It has a high speed of 114 m.p.h., and a cruising speed of from 95 to 100 m.p.h. with a ceiling of 14,000 ft. The useful load capacity is 4,000 lb., while the weight of the plane empty is 6,000 lb. Further specifications of this plane are contained in the Commercial Airplane and Seaplane Table. When this plane came off the assembly line the Airplane Division of the Ford Company doubled its production. During March the production rate was two complete planes per month. As this output was not sufficient to keep pace with the rapidly accumulating orders, early this month the rate was changed to four completed planes each month. Early in March the plant began producing one fuselage each week at which time approximately 300 men were at work in the plant in two daily shifts.

SWALLOW AIRPLANE MFG. CO.
Wichita, Kan.

This company is exhibiting in 2,500 sq. ft. of floor space one standard Swallow biplane fitted with an OX-5 engine, and another mounted on Hamilton pontoons. The standard Swallow is a three place open cockpit single bay biplane. The seating arrangement allows for two persons in the front cockpit and one in the rear. The fuselage is of welded steel tubing construction and the wings are of wood, fabric covered, with streamline wire bracing and N type interplane struts. The fairing for the pilot's head is standard. The control is of the dual stick and rudder bar type, and the plane is fitted

Front quarter view of the Swallow biplane fitted with an OX-5 engine.

with an adjustable stabilizer. The engine choke is located on the instrument board. A split type landing gear is used with rubber in tension for the shock absorbers. The plane has been issued Approved Type Certificate No. 21.

The high speed of the land plane is 95 m.p.h. and the landing speed is 35 m.p.h. The span is 32 ft., the overall length 24 ft., and the overall height 8 ft. 8 in. Empty the plane weighs 1,400 lb. and fully loaded 2,200 lb. Further specifications will be found in the land plane and seaplane specification table. A detailed description of this plane appeared in the April 5, 1926 issue of AVIATION.

TRAVEL AIR MANUFACTURING CO., INC.
Wichita, Kan.

This company which produced the "Woolaroc" which won the Dola Derby last year is exhibiting two planes in a display area of 3200 sq. ft. One is a Travel Air powered with

Front quarter view of the Travel Air, Type 2000, powered with an OX-5 engine.

an OX-5. This plane which is known as type 2000 is a standard three place, open cockpit biplane. The high speed is 100 m.p.h., and the minimum speed is 42 m.p.h. The span is 34 ft. 5 in., the height is 8 ft. 5 in., and the overall length is 24 ft. 2 in. The wing area is 296 sq. ft. and the wing

section is Travel Air No. 1. The weight empty is 1335 lb, and the gross weight fully loaded is 2180 lb. The fuselage, tail surfaces, chassis, and struts are colored Travel Air blue, upholstery is Fabrikoid and wheels are Hayes wire, 26 x 4.

The second plane being exhibited by this company is the standard Travel Air powered with a Siemens-Halske 125 hp. engine. This plane which is also a three place, open cockpit job, has a high speed of 115 m.p.h. and a minimum speed of 42 m.p.h. The other specifications are the same as type 2000. Complete specifications for both these planes will be

Front quarter view of the Travel Air fitted with a 125 hp. Ryan-Siemens engine.

found in the Commercial Airplane and Seaplane Table, and the engine specifications will be found in the Engine Specifications Table.

This company also manufactures the well-known Travel Air mail plane, and also the standard Travel Air powered with either a Wright Whirlwind or a Fairchild Caminez engine. Walter Beech, president and general manager of the company, is in charge of the exhibit.

TAYLOR BROTHERS AIRCRAFT CO.

Rochester, N. Y.

This company, which was formerly the Arrowing Airplane Co., is exhibiting in 1,000 sq. ft. of floor space its plane known as the Taylor "Chummy". It is a high wing monoplane with two seats side-by-side and completely protected from the wind by wind shields. The plane is designed for training and pleasure flying, and according to the officials of

Front quarter view of the Taylor "Chummy" fitted with a 90 hp. Anzani.

the company the low landing speed, ease of maneuverability and lightness, also make it highly desirable as a cross-country plane. The plane on exhibition is powered with a Ryan-Siemens engine.

The first model made by this company was powered with an Anzani 90 hp. engine. Another difference between the two models is that the new production plane is equipped with a split type axle landing gear, whereas the Anzani model was fitted with a rigid axle. The span of the new model is 34 ft., the length is 22 ft., the height is 7 ft. 9 in., and the wing area is 175 sq. ft. Empty the plane weighs 975 lb. The

total weight is 1,475 lb. The top speed is 110 m.p.h. Cruising speed is 95 m.p.h., and landing speed is 40 m.p.h.

Further data regarding this plane will be found in the Commercial Landplane and Seaplane Specification Table. C. S. Taylor, president, is in charge of the exhibit.

CHANCE VOUGHT CORP.

Long Island City, N. Y.

This company is exhibiting two of its latest high performance 2 place "Corsair" planes in a display area of 4500 sq. ft. One is fitted as a landplane and the other as a seaplane. The exhibit also contains models of Vought products and photographs of Vought planes in action in various parts of the world. The landplane exhibited is a standard plane built for Asst. Secy. of the Navy for Aeronautics Edward P. Warner, and is to be used by him in all of his official trips throughout the country. It is finished in an effective color combination of navy blue and silver. The side fuel tanks are polished

The Vought "Corsair" (Wasp) fitted as a land plane

as are also the landing gear wheels and other portions of the cowling, etc. It contains standard dual control with the rear stick being removable, and flying instruments that are installed in both cockpits. The rear cockpit is fitted with a writing desk and map cases, etc.

The seaplane Corsair on exhibition has been assigned to the Bureau of Aeronautics, Navy Department. It embodies the same features of finish and equipment as the landplane. All Corsairs are of the convertible type being quickly changed from landplane to seaplane by interchangeable landing gear.

Side view of the Vought "Corsair" fitted as a seaplane.

The Corsair seaplane on exhibition, as well as all standard production type Corsairs, is equipped with an especially designed all-metal float type landing gear built entirely of duralumin. This float type landing gear and the entire plane is designed for catapulting. Both of the planes on exhibition are of the type which holds four world seaplane records for altitude and speed. After the Show the two planes are to be

set up at the Ford Airport and delivered to the Navy there for flight to the Naval Air Station at Washington, D. C.

The exhibit is in charge of Temple M. Joyce, manager of sales and service, Chance Vought, president of the company, is also in Detroit during the Show as well as C. J. McCarthy, engineering executive, and Paul Becker, assistant to Mr. Vought.

WALLACE AIRCRAFT CO.

Chicago, Ill.

The exhibit of this company covers 1200 sq. ft. of floor space and is featured by the showing of a new two place cabin sport plane known as the "Touroplane". This plane which is a high wing braced monoplane is powered with an 80 hp. Anzani engine; the plane can be made a three place job. The plane has two front seats side-by-side enabling dual control with only one control stick midway between them. In the case of a three place job a third seat is placed between and to the rear of the front seats. Plenty of baggage space is available. The cabin is richly upholstered in velour and allows for ample leg and head room. The cabin of the plane on exhibition is 36 in. wide but in future Touroplanes the cabin will be made 42 in. wide. A steel firewall separates the cabin from the engine. The roof of the cabin is the center sec-

Side view of the Wallace "Touroplane" fitted with an 80 hp. Anzani engine.

tion of the wing. The windows are of safety glass and a door is provided on each side. The windows of the Touroplane may be folded back. They are otherwise of a conventional construction with solid spruce spars and Warren truss ribs. Spar material is from Posey, and Flightex fabric is used. The brace struts are streamline steel tubing.

The fuselage is constructed of welded steel tubing and a of Pratt truss structure with no wires. The turtle deck a built of spruce strips and the engine mount is detachable. Control surfaces are of steel tubular construction and the rudder and elevator are interchangeable. Arens control is used for the adjustable stabilizer and all other controls are of the bellcrank type actuated by steel tubes. Dual pedal rudder control is provided. The overall length of the Touroplane is 23 ft. 6 in. The wing span is 37 ft., the overall height is 7 ft. 6 in., and the chord is 5 ft. 10 in. The total wing area including ailerons is 205 sq. ft. The weight empty with the 80 hp. Anzani engine is 850 lb. The useful load is 650 lb., and the gross weight loaded is 1500 lb. According to the manufacturer the high speed of the Touroplane is 95 m.p.h., the landing speed 40 m.p.h., the cruising speed is 80 m.p.h., and service ceiling is 11,500 ft. The equipment of the Touroplane includes Hartzell walnut propeller, hydraulic compression shock absorbers, dual Arens control with stick cables and push rods, navigation lights, and an Elgin unit instrument board, consisting of an Elgin tachometer, altimeter, oil pressure gauge, oil thermometer, gasoline gauge, dual switch and choke, etc. Further specifications of the Wallace Touroplane will be found in the Commercial Landplane and Seaplane Specifications Table.

Side Slips

By ROBERT R. OSBORN

The Intrepid Aviator was in to see us again, after being away for a long while. He said that it had come as a complete surprise to him that the endurance record for airplanes had been brought back to this country again, as he had thought that all of the newspaper headlines about the Haldeman-Stinson partnership were referring to another companionate marriage.

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In the rules and regulations for the All-American Aircraft Show we find a note to the effect that "No crates will be allowed to remain in any space during the show". This is just another example of the great strides being made in aeronautics recently. Not very many years ago a rule like that would have kept nearly all of the existing airplanes from being exhibited.

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Congress is now considering a bill which would provide a governmental contribution of $300 to the International Society for the Exploration of the Arctic Region by Means of the Airship. We'll bet that the bill passes without any sort of debate. There are plenty of long-winded spellbinders in both House and Senate, but it would take a pair of them, working in relays, to make a really dramatic speech about any organization with a name like that.

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This society was featured in the news a while ago, and we inquired at the time as to what sort of a title would be given its president. Congress might do well to get this point settled before making any contributions to their treasury. If the society ever makes any meritorious additions to our scientific knowledge of the Arctic regions with their explorations, their president might have to be awarded a very expensive overseas medal, or possibly a series of six or seven medals, in order to get space for all of the engraving.

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The news reports that when the question "Would you marry Lindbergh if you had a chance?" was given to a hundred and fifty girls at the University of Missouri, only twenty-nine said "Yes". The reporter neglected to state whether the other hundred and twenty-one said "You bet I would" or "I should say so."

• • • •

A German designer has recently arrived in this country with the announcement that he will establish a factory here patterned after his German factory, to make a small airplane of the "flivver" type. His practice in the past has been to employ no one in any capacity in his plant who cannot pilot an airplane.

Possible future advertisements in AVIATION—

"Experienced stenographer desires position. Four hours on Jennies, 3000 hours on Remingtons and 2500 hours on Underwoods. Holder of Chewing Gum Endurance Record 1926. Expert on air-cooling undesirable visitors to offices."

• • • •

Recently in Vienna a hotel proprietor has been having beer delivered to his hotel from airplanes, each keg having a parachute attached and being dropped over the side. Such a scheme might work over here for the delivery of beer, but it would be a too heart-breaking assignment to ask a pilot to risk dropping any other liquid refreshments with only a parachute for protection.

FOREIGN NEWS

By Special Arrangement with the Transportation Division Bureau of Foreign and Domestic Commerce

To Make Aerial Surveys in India

Aerial surveys are to be undertaken by the British Indian Governments of Bengal and Bihar-Orissa, according to Vice Consul Richard R. Willey at Calcutta. A coastal plain survey is to be made in Bihar-Orissa in connection with the inquiry into the prevention of floods, while air data will be gathered in Bengal to be used in the study of a settlement scheme in the Malda district.

The coastal survey flights, to be made from a base at Cuttack, will cover a distance of 164 mi. with extensions inland at the mouths of the Dhamra and Devi Rivers. The Bengal headquarters will be at Methurapur.

Some 7,000 photographs on the scale of 8 in. to a mile are to be taken. The total area to be surveyed is 1,600 sq. mi.

Prizes Offered to Keep France in Lead

To maintain France's leading position in aviation, the French Government is offering 1,000,000 francs (approximately $40,000) in prizes to French pilots breaking air records, the Minister of Commerce, Maurice Bokanowski, has announced. These prizes will apply for new distance, speed, weight carrying, and altitude marks made in either land or seaplanes.

Independent of the Government offer, there are many prizes open for a trans-Atlantic flight. Among these is a handsome trophy and cash award posted by Le Matin, a French newspaper, for the first all-French Paris-New York flight.

France Plans Plane and Glider Contests

With the aid of the Government's *Direction Generale de l'Aeronautique*, two international contests, one for gliders and the other for light planes, will be organized this year in France by the French Aerial Association. *(Association Francaise Aerienne)*

A further indication of European interest in light and engineless planes is shown by these contests, in which prizes will total at least $4,000 for the glider competition and $6,000 in the light plane meet.

Friedrichshafen to Have Great Airport

Work on a large new airport, which it is expected will assume international importance, is to begin on or about July 1 at Friedrichshafen, Lake Constance, Germany, it has been announced. It is expected that the new field will be ready to care for traffic by the summer of 1929, the building of a new hangar and the installation of a drainage system necessitating some nine months of work.

The cost of the undertaking is to be shared by the German Government, the State of Wurttemberg, the City of Friedrichshafen, and the Dornier Metal Works.

Invents Airplane Engine Silencer

An appliance designed to silence airplane engines has been invented by an Oslo, Norway, engineer, according to reports. The apparatus was tried on a 120 hp. engine, and raports of the experiment claimed that the device reduced 1400 r.p.m. by but 20 r.p.m., or 1 per cent. of the total power.

The appliance, which is built upon the vacuum principle, is attached to the exhaust manifold of the engine. It consists of a streamlined sheet metal drum into which the exhaust pipes are led. It weighs less than 22 lb. and is said to be fireproof.

London-Cannes Passenger Line Opens

Daily passenger air service was recently inaugurated by the Air Union Co. between London and Cannes, France. The planes leave the English capital at 6 A.M., reach Paris at 9.30 A.M., Lyons at 1 P.M., and Marseilles at 3:15 P.M. Here passengers change planes and continue to Cannes, arriving at 5 P.M. The fare from London to Cannes is about $65.

French Aero Insurance to be Compulsory

French Chamber of Deputies members recently approved an act calling for compulsory accident and life insurance for both military and civil aviators in France. The ruling, expected to be effective soon, will call for indemnities for death or total disability ranging from $4000 for officers down to $1000 for enlisted men. A scale for civilian pilots will also be arranged.

To Introduce German Gliders in U. S.

The Rhoen-Rossitten Co. of Germany announced recently that it would accept the invitation of the American Motorless Aviation Club and send an expedition of gliders to this country. The group, composed of Cavalry Captain Roehrer, Dr. George Laubenthal, and Herr Hesselbach of the Academic Fliers Association of Darmstadt, will leave for America late in April.

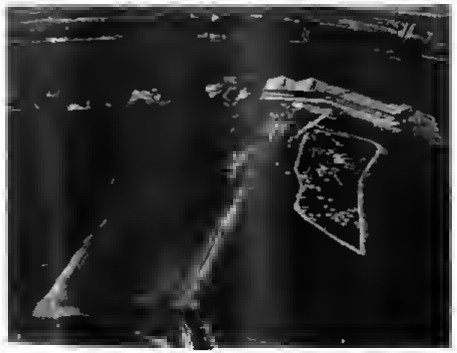
To Open Russo-Afghan Service

Russia and Afghanistan have drawn up an aerial agreement, it is reported, calling for service between Tashkent, in the former country, and Kabul, Afghanistan. According to the agreement, two planes will be used each of which is to make fortnightly trips between the two cities.

First Canadian Whirlwind Manufactured

The Canadian Wright, Ltd., Montreal, Can., a subsidiary of the Wright Aeronautical Corp. of America, has completed its first Wright Whirlwind engine—the first to be assembled in Canada. These engines will be used by the Patricia Airways, Ltd., and the Canadian Western Airways at Winnipeg.

In The Antipodes



Australian Aerial Services, Ltd., operates this airport at Melbourne, Australia. Hangars face both the field and the river in the rear, which provides a seaplane base.

AIRPORTS AND AIRWAYS

Detroit, Mich.

By John T. Nevill

Flying 900 mi. in 10 hr., Rodney H. Jackson, Michigan distributor for the Swallow Airplane Mfg. Co. of Wichita, Kan., returned to Detroit recently with the Swallow biplane purchased by the Detroit Air Yacht Club, of which Jackson is secretary. The flight from Wichita to Detroit, via an overnight stop at Marshall, Mo., is said to have set a commendable record for a plane powered with an OX-5 engine.

Jack Workman, of the Michigan State Aviation School, accompanied Jackson in another new Swallow, the property of Howard Hartung, partner of Pat Touhey, in operation of the Packard Flying Service, now affiliated with the Michigan State Aviation School. Both planes will be housed at Packard Field.

Mickey De Burger, holder of the world's record for the greatest number of parachute jumps in one month will attempt to beat the present delayed drop record during the All-American Aircraft Show. The jump will be made over Packard Field. In July 1925 De Burger jumped 93 times. Having jumped, in all, more than 900 times he will try to beat the record of Joe Crane, who dropped 4,200 ft. in January 1926 at Miami, Fla., before opening his 'chute.

William B. Mayo, chief engineer of the Ford Motor Co., took off recently in a Ford tri-engined plane for the West Coast on a business trip. The plane is one recently purchased by J. L. Maddux, head of the newly organized Maddux Air Lines, Inc.

Delivery of a new Waco biplane was made to Fred Stone, stage star, while he was filling an engagement here recently. Stone, who plans to use the plane in his theatrical tour, kept it at Ford Airport during his stay here.

Louis G. Meister, sales manager of the Buhl Aircraft Co., recently announced the appointment of Bob Blair, veteran Army and mail pilot of Los Angeles, as California distributor for the Buhl Airsedan. Following the appointment, Blair left for California with a new plane, which he plans to use in demonstrations.

Prof. Peter Altman, of the University of Detroit, addressed the Detroit Flying Club recently on "Advanced Aerodynamics and the Theory of Flight."

Another speaker was O. M. Butler, head of the Department of Commerce Detroit office, who spoke before the Harvard Club on aviation and the All-American Aircraft Show.

Portland, Ore.

By John W. Anderson

The Casco dian, tri-engined Bach cabin monoplane, now in passenger service between Portland and San Francisco, has been entered in the non-stop transport plane race between San Francisco and Los Angeles scheduled for April 15, according to Charles V. Eakin, president of the West Coast Air Transport Co., owner of the plane. On its maiden trip the Casco dian went from Los Angeles to San Francisco in exactly three hours, said to be a record for any but a single place plane.

Work on construction of a three-unit hangar for the big West Coast planes has been started on the Port of Portland Airport. The building will be 145 ft. long and 45 ft. wide. It will contain shops as well as room for the planes. It is being built of corrugated iron. A 1000 gal. gasoline tank and and electric pump are being installed. These will be available for servicing planes of other companies on the field, Mr. Eakin said. Other development work on the field is progressing rapidly and companies expect to move to it soon.

William Pickens of New York City, field secretary for the National Association for the Advancement of Colored People, filled a speaking engagement in Portland the night after he spoke in Oakland, Calif., recently. The long jump between engagements on successive nights was made possible by taking passage on a Pacific Air Transport mail plane.

H. R. Reeves, representative of the Kinner Airplane and Motor Co. of Glendale, Calif., visited Portland recently, looking over the ground with a view to possible location of a branch factory here.

J. O. York, piloting a York monoplane of his own manufacture and design, stopped at Rankin Field here recently on his way from Santa Monica, Calif., to Aberdeen, Wash., where he is establishing his factory.

James C. Rinehart, 19 yr. old licensed pilot, has bought back the old Jennie that he reconstructed three years ago from parts of various planes. Two years ago Jimmy sold the plane and bought a new Travel Air which he flew out from the Wichita, Kan., factory. He went to Long Beach, Wash., recently and brought it back to Portland with him.

Philadelphia, Pa.

Charles Townsend Ludington, president of the Ludington Philadelphia Flying Service and of the B.B.T. Corp of America, airport lighting specialists, has returned to Philadelphia from a three months' vacation in the South. A new plane ordered for his personal use has arrived at the airport. It

Violators of our regulations must beware of Edward Clarke. He is Philadelphia's first flying policeman.

is a Waco 10 with a Siemens Halske engine. Robert P. Hewitt, manager of field operations at the airport, flew the plane from Troy, O., making the 480 mi. hop in 4 hr. 5 min. He was accompanied by R. J. Phillips, shop superintendent.

Eleven new members were admitted to the Aero Club of Philadelphia at a recent meeting and have been assigned to the second squadron under command of Capt. George Jackson. J. Wesley Smith, president of the Philadelphia Air Transport Co., addressed the club on "Theory of Flight" and Lieut. S. A. Latham spoke on "Tail Spins".

The club's Heath Parasol plane, recently ordered, has been shipped from the factory at Chicago and is expected here soon.

The Ludington company's Fairchild cabin monoplane has been equipped with a new landing gear at the Fairchild factory at Farmingdale, L. I., and flown to the Philadelphia Airport by R. J. (Jack) Bartow, assistant manager of field operations for the Ludington Philadelphia Flying Service. He was accompanied by O. L. Davis, who recently started work at the Philadelphia Airport as sales representative for the Ludington company.

Lincoln, Neb.

By Duncan Price

The Boeing Airplane Co. of Seattle, one of the largest air transport organizations in the United States, has announced that there was a possibility of a change being made in its trans-continental air routes in order that Lincoln might be included.

The company's present mail route from Omaha includes Cereseo, Valparaiso, Central City, and Grand Island. The proposed changes mean that the route would extend south at Gretna, coming through Lincoln, Seward, York, Aurora, and Grand Island. Officials of the Boeing company said there is no difference in miles in making the change.

William P. MacCracken of the air division, Washington, D. C., already has assured his cooperation in moving the beacon lights over the proposed route, provided Lincoln furnishes adequate airport facilities.

Fifteen thousand dollars' worth of improvements will be made on Grand Island's landing field within a few months. Specifications for the improvements are now being made.

The local American Legion post has secured an option on a quarter section of land near the city for use as an airport. There is only one hazard, a cable strung on the east side, and that can be eliminated by lowering the poles. Now used for ordinary farming purposes, the land could be converted into an airport with very little work. The option expires July 1. The Legion is sponsoring the movement for the establishment of an airport.

Whirring engines in the air kept him and his wife from sleeping, frightened his chickens to death, made his cows stingy, annoyed his horses, Emil Glatt contended in his suit against the Standard Aircraft Co. in district court here. He asked $10,000 damages and an injunction to prevent planes from flying low over his farm. The court took the case under advisement. The aircraft company's flying field adjoins Glatt's farm.

Dallas, Tex.

By Rose E. Cowden

Love Field, a 167 acre tract, improved and maintained as a training field by the government during the war, has been purchased by the City of Dallas as a municipal airport. The city has had the field under lease for several years. The consideration was $325,000. Present plans call for an expenditure of $75,000 for immediate improvements. The field is equipped with 11 hangars, most of which are privately owned. It is expected that the city will erect a large municipal hangar and club house.

Lieut. George W. Hopkins, piloting a Stinson-Detroiter cabin monoplane, carrying four passengers, landed at Love Field recently. The passengers were Richard J. Wall, Toledo, representative of the National Safety Council, John C. Ingram, of the Universal Press; W. G. Fisk, engineer for the Radio Corp. of America, and Capt. H. Gordon Smith,

of the New York American The plane was equipped with a 100 watt, standard commercial, combined telephone and telegraph radio transmitter. A coast-to-coast trip, sponsored by the New York American, is being made to determine the possibilities of the new type equipment.

April 21 and 22 have been designated in Dallas as "Aviation Day" and will be observed at Love Field with air races, exhibition flying, and a free-for-all race.

The two radio antennae towers which have been hazards to aviators operating at Love Field for some time, are to be dismantled following experiments with a new type of sending apparatus. The new type equipment will be installed as soon as possible and requires only a short antennae which can be stretched along the comb of the hangar Operators who will attend the reserve officers summer training camp at Love Field this year will receive instructions on the operation of the new equipment.

Eighteen states are represented in the student body of the Dallas Aviation School. L. A Winship, president of the school, reports 42 enrollments during the past eight weeks. Lincoln-Page and Swallow planes are used for advanced training

Howard Woodall of Travel Airways, state distributor of the Travel Air, reports business on the increase in every branch A large number of students are enrolling for spring training Business men are beginning to realize the convenience of air travel and are keeping their cross-country pilots busy a large part of the time

Waterloo, Ia.

The Waterloo Airport Corp, formed here last fall by the city's leading business men, has purchased 120 acres of well drained land in the shape of an "L" lying three miles due east of the city. This field affords a take off in six directions with a 2,600 ft. run available.

The new field has been equipped with a regulation beacon mounted on a 50 ft. steel tower, boundary lights, and red lights on all obstructions There are four floodlights to illuminate the field at night A tile hangar 74 ft. by 100 ft was completed last fall, a work shop and office adjoining it.

The Hawkeye Air Transport, Inc., was organized late in 1927 also, This company has leased the field and will use it for commercial flying purposes. The officers are C. A. Morris, president W. F. Marshall, vice president, and A. B. Chambers, secretary.

John W. Cable will have charge of the Hawkeye company's flying, having been recently selected for this capacity Cable has been operating a field of his own for the past two years.

During the winter, the Hawkeye company took the Travel Air representation for the state. At present two Travel Airs are being flown, while a four or six place plane is to be purchased in the near future, it is said.

M. F Marshall has flown sufficient hours to take his Transport Pilot's License examination Marshall took much of his training last spring

Hawkeye Air Transport officials were recently given a demonstration of the Fairchild plane, one being flown in from Moline, Ill., by E K "Rusty" Campbell.

The City of Waterloo and the two companies invite all pilots and airmen to visit the field

Charleston, W. Va.

The Aero Club of Charleston, formed in October 1927, has been enjoying rapid expansion during the last few months. The total membership is now 43, and it is expected some five hundred will belong before the fiscal year ends.

The club's flying field here is located six miles from the city midway between Charleston and Dunbar Work on the field is now nearing completion, the construction of two

hangars and a club house being under way Gasoline and oil will be available to visiting airmen, and the club extends the use of the field to the city as a commercial airport.

The field, which is marked, may be located from the air by its adjacency to Lock No. 6 on the Kanawha River. The prevailing winds are westerly, the field is 3,000 ft. long and 300 ft. wide.

Trustees of the Aero Club of Charleston are ex-service men, some of whom were connected with the air service. The club officers are James J Cabot, president, son of Geoffrey L. Cabot, one of the governors-at-large of the N.A.A.; Walter E. Irwin, vice president; H. F. Milbee, secretary, and E. H Ross treasurer. The club trustees are George Mathis, Jr., Lowell Childress, and George Smith. The club's chief pilot is Howard Mayes who has had more than 700 hr. in the air. During the war, Mayes was captured by the Germans after his plane had been shot down behind the lines.

Springfield, Mass.

By Charles Hanson Gale

The city airport committee recently held its first meeting of the year and decided to solve the present airport problem by obtaining a five-year lease on some suitable field in or near the city with the option to purchase. This would provide an airport for the present and leave the city free to move to another site if subsequent study produced a more favorable location.

Drinkwater Field at East Longmeadow appears to be the favorite and the committee admitted that negotiations have been started in that direction The price of the land has jumped 150 per cent. from $200 an acre to $500 an acre since the first option held by the city expired last December The field is declared by experts to be admirably suitable and sufficient for all that Springfield would need.

The other outstanding possibility has been Dunn Field of Longmeadow but the wave of protest among the citizens of that town has discouraged progress in that direction The field is not regarded by many as well suited for all-round development as Drinkwater.

About 5,000 pieces of air mail were sent out by this city on the maiden run of the first air mail motorcycle service in the world on March 15 The event evoked considerable interest here and the amount of air mail sent out by local business houses is said to have doubled with the inauguration of the motorcycles. Mayor Fordis C Parker, Aldermen J Frank Tucker, chairman of the city airport committee, Postmaster W. Kirk Kaynor and other officials were among those to make the first run over the route as escorts in the wake of the motorcycles.

Salt Lake City, Utah

By E. E. Hale

Following a brief visit at Salt Lake's airport of Clarence M Young of the Department of Commerce, in which he made some observations on improvements, the city commission has appropriated $6500 for immediate expenditure. Also, on Mr Young's suggestion, stricter regulations are to be made effective at the landing field in respect to visitors entering in upon the field when planes are in motion

The committee is now rushing work on drainage, comfort stations, sewers, water mains, oil surfacing, cindering, painting of buildings, and other such improvements at the airport

Flying one of the regular type Boeing mail planes equipped with a Hornet engine, the Boeing Air Transport hauled a record load of mail east from here a short time ago. The cargo weighed 1800 lb. Two passengers were aboard. The load came through consolidation caused by delays on account of weather

Western Air Express, Inc., operating the air mail between Salt Lake and Los Angeles plans inaugurating a passenger carrying line of planes early this spring The new planes will

be cabin craft to replace the Douglas planes now carrying one passenger. Maj. C. C. Mosely in charge of operations promises a surprise when the new line is announced.

Alfred Frank, president of the National Parks Airways, which is to operate the mail line between Salt Lake and Great Falls, Mont., returned recently from a trip to all the stop cities. He reports increased interest and enthusiasm over the opening of the line planned for some time in June. Super-Universal Fokker planes, carrying six passengers each, are to be used on the route.

Los Angeles, Calif.

By Charles F. McReynolds

Announcement that the Los Angeles city council has definitely taken steps to purchase and equip three municipal airports with a total area of 2213 acres is the greatest stride yet taken in the development of commercial aviation in Southern California

Besides the three new municipal fields there are eight well equipped private fields now operating within a radius of five miles from the heart of the city.

A fourth municipal field which combines land and seaplane facilities is also under development at San Pedro

Here are the members of the Belmont High School Aero Club of Los Angeles awaiting flight instruction at one of the local airports. With classes in aeronautics taught in many schools youth is rapidly becoming air-wise.

Harbor on the territory known as Dead Man's Island. This field will be used by the naval planes because of its proximity to the fleet operations which are based on Los Angeles Harbor.

The three municipal fields finally selected, approved by the city council, and now in the process of development are Vail Field, the western terminus of Western Air Express, the Mines site, which is a well situated airport location in the southwestern portion of the city; and the Sesnon site which is by far the largest field but because of its distance from the business district (about 23 mi.) will be used chiefly for aerial race meets and as an emergency field in case weather conditions are bad at the other terminals.

All in all, it really looks as though the City of Los Angeles would shortly be one of the best equipped municipalities in the world in number and location of desirable airports.

Tampa, Fla.

Tampa's new airport is west of the city near the Bay By automobile it is reached over the Memorial Highway turning right at West Shore Drive. It is large and level and various accommodations such as showers, rooms, etc, are being arranged for the convenience of visiting pilots.

G G Harned of Travel Air is working up a good deal of aviation enthusiasm among local sporting and business men with his demonstration rides in a big transport cabin monoplane McMullen Aviation School, which is Travel Air distributor for the state, also has a Travel Air biplane on the line with Cummer engine.

Several students are enrolled at the field, one having purchased a Travel Air with Cummins engine for spring delivery. Another—Harold A Meres, advertising manager of a Tampa concern, has just started his solo work.

Fifty or 60 state and out of state pilots have landed at the new field since its opening. Among these was Eugene Detmer who finished fourth in the New York to Spokane race. He has been in and out of many Florida airports recently, his instrument board being the envy of local pilots wherever he lands. He signed out for Pensacola.

Frederick Lund stopped recently on his way to Havana, delivering a new Waco Whirlwind for use on a line in Cuba

Oklahoma City, Okla.

By Ernest W. Fair

The Texas Company's tri-engined Ford-Stout plane gave the Governor of Oklahoma his first airplane ride when it took him and a party of state and city officials into the air on its visit here

Cars are getting too dangerous, says J W Bell of Lindsey, drug store operator, who has purchased a Ryan-Siemens powered Eaglerock from the Southwest Airways Co

Oklahoma City has been selected as one of the stopping points in the proposed transcontinental air races which are to be held in September, H C. Martin, chairman of the aviation committee of the local chamber of commerce has announced Acceptance of the place is to be considered soon by the committee who will draw up plans for entertaining the racing fliers.

A plea for concentration of efforts of civic, official and industrial Oklahoma City to establish the municipality as a manufacturing center for airplanes was made by W. S. Estes, secretary of the State Chamber of Commerce in a meeting of the Oklahoma City Jobbers and Manufacturers at the Oklahoma Club recently. Estes cited the natural opportunities afforded by the city as a reason why the aviation industry should thrive in this locality.

Sunday exhibition flights at the municipal airport will be abandoned temporarily, it has been announced.

Responsibility for accidents which may occur at the municipal aviation field is not assumed by the city, it has been announced by the city clerk, Mike Peshek, Jr. The Chamber of Commerce has filed a bond with the city assuming liability for accidents.

"There is a pronounced social use for air mail, it should be confined to business," said C. B. Braun, Dallas, division traffic manager of the National Air Transport Co. in an address here to the Hospitality Club. "Trade areas are defined by transportation facilities and a progressive town must follow the modern transportation devices if it expects to grow," Braun also said.

New Orleans, La.

By William DeWald

William N DeWald, operations manager, and Victor F Grima, traffic manager, of the St. Tammany Gulf Coast Airways, Inc. operators of C A M No 23, have just completed a trip in the company's Fokker Universal to Mobile, Birmingham, and Atlanta, which points are along their route, completing final arrangements for the successful opening and operation of the New Orleans-Atlanta route about May 1 Connections will be made at Atlanta with C A. M. No. 19 from Atlanta to New York, operated by Pitcairn Aviation Co. The two lines, namely the entire route from New Orleans to New York will be opened on the same day

The survey of the New Orleans-Atlanta section of the route, which is under the direction of Alvin Smith, airways exten-

sion superintendent for the Department of Commerce is progressing rapidly, but the lights will be installed only after July 1 Until that date the contractors are to adjust their schedule so that the entire route will be flown by daylight.

St. Louis, Mo.

By M. L. Alexander

In accordance with its annual custom spring has come to Lambert-St. Louis Field. The mud on the runways has dried and one may take off and get down again without the prospect of burying one's front teeth in the instrument board. And there are other signs.

All of the buses that have been accumulating dust in the hangars all winter long, have been dragged out for a thorough inspection and an overhauling. Dozens of students are to be seen daily standing open-mouthed about overalled instructors, and on any day a half dozen planes are in the air or buzzing away on the line.

Across the river, at the Parks Airport, workmen have completed the Parks Airlines School building and installed the big gasoline tank. The lunch stand is partly completed and a contract has been let for the construction of two shop buildings 28 ft. wide and 76 ft. long, and a 60 by 120 hangar.

J. L. Phillips and R. S. Lamount, Standard Oil Co. pilots, brought in a Ford Tri-Motor with five railroad officials of Chicago as passengers. The railroad men attended a luncheon at the Missouri Athletic Association and hopped back to Chicago in the afternoon, leaving St. Louis at two o'clock and arriving in Chicago shortly after five.

Paul F. Baehr and George B. Arnold of the Buhl Aircraft Co. of Marysville, Mich., visited St. Louis on their way from Wichita to their factory, and demonstrated their plane, an Airsedan, to the pilots and mechanics at the field.

Claude Sterling of the Parks Airlines brought in a new OX-5 Travel Air biplane from Wichita recently Two of Parks planes are to be used by Allan T. Spivey, East St. Louis newspaper publisher, who will leave Parks Airport soon to stump the State in the interests of his candidacy for Congressman-at-large. The planes probably will be piloted by Clyde Brayton and Joe Hammer.

"Brandy" Brandewede has been appointed manager of the Robertson Flying Services and as such will direct the Robertson Flying School and aerial services this summer

The chief pilot of the Robertson school will be Dan Robertson, who has been working in an office downtown during the winter. Robertson was formerly one of the most active fliers at the field

Kansas City, Mo.

By H. H. James

The Bennett Flying School, Kansas City, has inaugurated a new policy of paying the fare of students from several points in the United States to Kansas City. Arrangements have been made by the school with the Ni-Sun Bus Lines, and allied lines of transportation, to transport students from Detroit, St. Louis, Chicago, Denver, and Tulsa, to the school.

A Stinson-Detroiter monoplane, carrying a pilot and four passengers on a 10,000-mile good will tour of the United States, made a stop at Kansas City recently. The plane is making the trip under the auspices of the New York American.

The airplane will play a big part in supplying the United States with the picture news of the Republican National Convention in Kansas City in June The Chicago Daily News has made arrangements for a daily airplane service between Kansas City and Chicago during the convention, the plane to carry movie reels and news photos. The flying time between the two cities is about five hours. The Chicago paper will have its chartered plane leave Kansas City in time so that pictures taken in the afternoon will appear in that paper the next morning Movie houses may even show the convention films the same day.

The Kansas City Chamber of Commerce will invite the 1929 National Air Races to that city. The aeronautical committee of the chamber has voted to send a delegation to the All-American Aircraft Show, Detroit, April 14 to 21, to lay the groundwork there for bringing the 1929 meet to Kansas City.

Cincinnati, O.

By Charles E. Planck

The Embry-Riddle Co. believes it has the highest speed average of any mail contractors, with an average of more than 100 m.p.h. for the first three months of operation. Stanley C. Huffman, operations manager of the company, and Warren Vine have frequently made the 270 mi. airline distance between Cincinnati and Chicago in 2 hr. even. Vine now holds the record—1 hr. 59 min.—while Okey Bevins has a mark of 2 hr. 7 min. chalked up as outstanding in his first month period.

Horace Dodge and two friends were in at Lunken Airport recently on their way to Palm Beach, Fla., Marion Sterling was the pilot Sterling told of a non-stop flight which he and two others had made March 24 from Jacksonville to New York, a distance of about 900 mi. in 7 hr. 20 min. He was flying Dodge's Stinson biplane With him were Horace Chase and Arthur Argles, who was with Steffanson at the South Pole. Sterling's passengers from Lunken Airport south were Dodge, Chase, and E. T. David.

"Weighing Day" was celebrated recently at the Halpin Development Co here. A pot received numerous monetary contributions following which guesses were ventured as to the weight of the Flamingo, the new all-metal monoplane. John Knoob, streamline expert working on the plane, guessed 2,850 lb. and won the $13. Ralph R. Graichen, chief designer, guessed it at 2,800 lb. His preliminary estimates had been close to 3100 lb.

Lunken Airport, Cincinnati, seems to have become a regular stopping place for Lindbergh. He dropped in three times during March, once during the dead of night on his unexpected return flight from Belleville to Washington. "Slim" ate lunch that day in a very masculine and not so highbrow lunch room where the Lunken Airport crowd eats when it's in a hurry and just before paydays. He ate or tried to eat a bowl of soup, one sandwich, and a glass of milk His wealthy friends, Bixby Robertson and Mahoney ate at the same place, in deference to John Paul Riddle's arrangements Lindbergh had whispered to Riddle, "Just keep me away from crowds." The day after, Louie, who waited table at the restaurant found out for the first time that one of his guests was the famous Lindbergh. Now he enjoys a sort of fame himself

Garden City, L. I., N. Y.

By M. Brown

A. L. Ceperton and Frederick H. Becker have returned to Curtiss Field as instructors for the Curtiss Flying Service. Becker is lecturing at present on Theory of Flight to the classes that assemble in the new Field Office, where ground school is being conducted Lectures on engines will begin in the near future, also a thorough course in navigation, with Herbert S. Huntington as instructor.

The youngest student at Curtiss Field is Mazel M. Merrill, Jr., eight years old, and son of M. M. Merrill, manager of the Curtiss Service. Mazel is not enrolled as yet for the student flying course, but he has had many lessons in actually flying a Fairchild cabin plane. Not being tall enough to reach the rudder bar, he is forced to sit on M. M. Merrill's lap when taking instruction. He has learned to keep the plane on an even keel and his banking is excellent. Mazel

is,looking forward to dual control instruction, which has been promised him as soon as he has grown large enough to reach the rudder bar

On Capt Rene Fonck's return to this country in May, a non-stop flight to San Francisco is contemplated, in the "Ville de Paris". Fonck is planning to carry a large number of persons to the Pacific Coast, as the plane will fly for 25 hr. with a normal load of gasoline and 10 passengers. Possibly an ocean flight will be attempted later in the season

A new Sikorsky Amphibian was recently delivered to the Sikorsky hangar at Curtiss Field, preparatory to being flown to Detroit for the Aeronautical Show. It is a two-engined plane, closely resembling Mrs. Grayson's Sikorsky "The Dawn" The cabin of the new plane is entirely enclosed in glass. At the conclusion of the Detroit show, it will probably be sold

St. Paul, Minn.

By H. A. Lindbergh

Curtiss Field, the first flying field in the Twin Cities, has been purchased by the William S Kling Co of St Paul at a consideration estimated to be about $100,000 This property, which is located on Snelling and Larpenter Avenues in Midway, will be used as an aviation and amusement center, the flying privileges of this 80 acre site having been leased by the Roth-Downs Airways, Inc, Travel Air distributor in Minnesota.

Gene Shank, chief pilot of the Pioneer Airways, has made several unsuccessful attempts in E. L. Gutterson's "Spirit of Lubrication" Waco to break the present endurance record for a lone pilot held by Col Charles A Lindbergh As the necessary gas supply would mean an initial load too heavy to enable the plane to rise, refueling was tried out while in the air. Although Shank is meeting with some of the difficulties encountered by other pilots aiming at endurance records he declares he will continue his flights until he is successful

The all metal Ford monoplane to be used by Commander Byrd on his South Pole expedition stopped over at the St. Paul Municipal Airport on its way to Winnipeg and The Pas in Canada The plane was piloted by Floyd Bennett and Bernt Balchen, with a mechanic and two news movie photographers as the passengers. The uneventful trip to St. Paul from Detroit was made in 3 hr 10 min

The Pioneer Press and Dispatch are sponsoring a model building contest to be held in connection with the Northwest Aircraft Show, with entries open to any boy or girl under 21 yr. of age. This contest will be in addition to that which will be held in May for the Boy Scouts under the direction of Frank R Niebel, the Scout executive.

Little Rock, Ark.

By Joe Harry Weston

There are four organizations in Little Rock for the promotion of aviation, The Little Rock Aero Club, Flying Razorbacks, the Little Rock Aviation Club, and the Argonaut Flying Club. The oldest is the Flying Razorbacks, a civilian club composed of the enlisted men of the 154th Observation Squadron, Arkansas National Guard. The purpose of the club is to promote aviation through the sponsoring of an circuses, and through civic work.

The Little Rock Aero Club, is the next oldest. It was organized in June 1927. Its purpose is the entertaining of prominent visiting fliers, and so gaining newspaper publicity for aviation Prominent business men of Little Rock are its officers and members. Its president is Gordon N Peay, a banker and its vice president is Tom W Freeman, a Ford automobile dealer

The Little Rock Aviation Club is a newly-formed organization the purpose of which is the instruction of its members

The Argonaut Flying Club is for the same purpose. Its members are all middle-aged business men.

Fargo, N. D.

There are now five planes in daily operation at the municipal field at Fargo and two new ones are expected within the near future. The flying school, of which E A. Canfield is the instructor, has nine students at present.

The Hector Airport, which is the municipal field, is expected to be in good condition for the take off and landings of planes during most any weather for it will be sodded, leveled, and filled wherever necessary An oil station will be placed in service on the field with an attendant in charge, the road will be re-graveled, telephone connections made, and the proposed hangar will be erected in the spring.

In addition to these improvements, an 8,000,000 candlepower flashing beacon light was put in operation on the roof of the Herbst Department Store of which J. Krohn Herbst is the president. This guiding light to the fliers is the second of its type to be placed in service in North Dakota, the first being the one that has been operated for nearly a year from the roof of the Prince Hotel at Bismarck.

Lieut. Verne L. Roberts, one of the entries in the National Air Derby during the past year, is expected home from the South soon to resume his customary activities at the Hector Airport. He is one of the best known pilots in this section and plays an important part in the promotion of aviation activities in Fargo.

Chicago, Ill.

In response to numerous requests, Erwin Baumgarth, sales manager, and William Burns, pilot, of the Commercial Aircraft Sales Co of Chicago, distributor of the Lincoln-Page plane, flew to Milwaukee recently to demonstrate one of these planes to a number of Milwaukee fliers and business men. A number of flights were made at the Milwaukee County Airport, the performance of the plane being commended.

Well pleased with the plane, representatives of the Wisconsin Flying Club placed an order for immediate delivery of a Lincoln-Page. The club is a new one, having been recently organized by a group of Wisconsin business men. A. A. Whitkus is president.

Olympia Fields Country Club, whose grounds lie some 27 mi south of Chicago's business center, is considering making part of the club land into an airport for the use of members. On one of the club's four courses the National Open Golf Championship will be played in June.

Olympia Fields will be remembered as featuring the first airplane golf contest several years ago Fliers dropped marked golf balls near the greens, following which golfers paired with the pilots played the holes out

Milwaukee, Wis.

By H C. Brunner

The fleet at the Milwaukee County Airport will be greatly enlarged as soon as deliveries can be made on a number of planes that have been ordered. The Midwest Airways, according to Neil Zimmermann, vice president, is to have two more Ryan monoplanes and two more Eaglerock biplanes.

Arthur Paukner, president of the Milwaukee Light Plane Club, is constructing an airplane in the basement of his home. The plane is powered with a light two cylinder engine, has a wing spread of 22 ft. and the enclosed cockpit fits in general lines somewhat similar of the Bellanca plane. There is just room in the cockpit for Mr. Paukner

Eddie Middagh is the new air mail pilot between Milwaukee, St Paul and Chicago who has succeeded Robert W. Radell. Eddie Middagh has about 2,000 flying hours to his credit. Radell resigned this route to fly the Kansas City route

UNITED STATES AIR FORCES

Marine Airmen Active in Nicaragua

A very important part is being taken by the U. S. Marine Air Squadron in breaking up the rebel forces of General Sandino, according to reports from Nicaragua. In a recent ground strafing engagement at Murra, 30 mi. north of El Chipote, the bandits suffered one of their most serious losses, General Sandino being reported to have lost nearly 90 men. After locating the rebels, the Marines dropped a full load of bombs among them, then returned for another load, repeating the process three times. During the battle, snipers hit one of the airplanes five times.

Flight Comdr. Maj. Ross E. Rowell, Capt. R. A. Presley, Capt. H. D. Campbell, and Gunnery Sergt. Michael Wodarczyk took an important part in this engagement. Gunnery

These Marine fliers took part in a recent engagement with the Sandinistas said to have resulted in a rebel loss of nearly three hundred men. Left to right: Gunnery Sergt. Michael Wodarczyk, Capt. H. D. Campbell, Capt. R. A. Presley, and Maj. Ross E. Rowell, flight commander

Sergeant Wodarczyk, who killed the leader of a bandit group at Dornih recently, narrowly escaped injury when one of the sniper's bullets pierced his parachute pack.

Test Convertible Sikorsky Amphibian

Under the supervision of Lieut. Comdr. S. V. Baugh, general inspector of naval aircraft, tests were recently made at Curtiss Field, L. I., of the new Sikorsky amphibian plane built for the Navy. Lieutenant Baugh was assisted by Lieut. George Haas, inspector, and Wilmer Stultz, pilot.

The new amphibian embodies Igor Sikorsky's convertible feature whereby it may be used as a commercial plane in peace times yet be quickly converted for military use in time of war. The plane is powered with two Wright Whirlwind engines, has a span of 72 ft., and is fitted with wing pontoons of improved design. It has a gasoline capacity of 308 gal.

Many Take Flying Cadet Examinations

Interest of the country's young men in aviation is shown by the fact that well over a thousand took the examinations on April 10 for appointment as Flying Cadet in the Army Air Corps. Examinations were held at the various Air Corps throughout the United States and insular possessions.

Only 110 new students may be accommodated at each of the two Air Corps Primary Flying Schools, one of which is located at Brooks Field, San Antonio, Tex., and the other at March Field, Riverside, Calif.

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TYPE.

ENGINE. One engine unless stated otherwise.

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POSITION.

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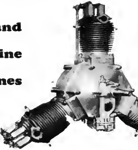
This table will appear monthly and corrections and suggestions are invited

Manufacturer or Agent	Engine	Cooling System	Cylinder Arrangement	No. of Cylinders	No. of Cycles	Propeller Drive	Rated Hp. and R.P.M. at Sea Level	Maximum Hp. and R.P.M. at Sea Level	Weight Dry Without Hub or Starter	Weight Per Rated Hp.	Bore and Stroke (In.)	Compression Ratio	B.M.E.P.	Displacement (Cu. In.)	Frontal Area (Sq. Ft.)	Diameter of Mounting Ring or Distance Between Bearers (In.)	Height or Overall Diameter (In.)	Length Without Starter (In.)	Guaranteed Fuel Consumption at Rated Hp. Lb./Hp./Hr.	Oil Consumption Lb./Hp./Hr.	Valve Mechanism	Rotary Induction System if Included as Standard Equipment	Cylinder Construction (See Key)	No. Intake Valves Per Cylinder	No. Exhaust Valves Per Cylinder	Make Spark Plugs Supplied With Engine	Type of Ignition	Make Ignition	No. Carburetors	Make Carburetors	Make Starter	Are Exhaust Manifolds Provided	Shipping Weight Crated	Cost at Factory
Aircraft Engine Co.	Comet	A.	Rad	7	4	D	130-1800		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Allison Engineering Co.	V1410	A.	IV-45°	12	4	D	400-1800	430-1800	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Allison Engineering Co.	VG1410	A.	IV-45°	12	4	G²	400-1800	430-1850	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Allison Engineering Co.	V1650	W	IV-45°	12	4	D	400-1750	440-1850	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brownback Motor Laboratories, Inc.*	Anzani 3-35	A.	Rad.	3	4	D	35-1750	45-1900	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brownback Motor Laboratories, Inc.*	Anzani 6-80	A.	Rad.	6	4	D	80-1860	90-1900	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brownback Motor Laboratories, Inc.*	Anzani 10-120	A.	Rad.	10	4	D.	120-1500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss Aeroplane & Motor Co., Inc.	OX-5	W	V-90°	8	4	D.	90-1400		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss Aeroplane & Motor Co., Inc.	OXX6	W	V-90°	8	4	D.	110-1000		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss Aeroplane & Motor Co., Inc.	C-6A	W	L	6	4	D.	160-1750	160-1750	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss Aeroplane & Motor Co., Inc.	D12	W	V-60°	12	4	D.	435-2000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss Aeroplane & Motor Co., Inc.	Conqueror V-1570	W	V-60°	12	4	D.	600-2400	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curtiss Aeroplane & Motor Co., Inc.	Conqueror GV 1570	W	V-60°	12	4	G²	600-2400	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fairchild Caminez Engine Corp.	Caminez 447-C	A.	Rad	4	4	D.	135-1000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hallett Mfg. Co.	[illegible]	A	Rad	7	4	D.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Irwin Aircraft Co.	Meteormotor 79	A.	Rad	4	[illegible]	[illegible]	30-1750	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Kinner Airplane & Motor Corp.	K-5	A.	Rad	5	4	D	100-1800		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Frank L. Odenbreit, Inc.	Floco A-7-R	A.	Rad	7	4	D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Packard Motor Car Co.	1A-2775	W	X-60°	24	[illegible]	D.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Packard Motor Car Co.	1A-1500	W	V-60°	12	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Packard Motor Car Co.	[illegible]	W	V-60°	12	4	G.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Packard Motor Car Co.	2A-1500	W	V-60°	12	4	D.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Packard Motor Car Co.	2A-2000	W	VI-60°	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Packard Motor Car Co.	2A-2500	W	V-60°	12	4	G.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pratt & Whitney Aircraft Co.	Wasp	A.	Rad	9	4	D.	400-1900	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pratt & Whitney Aircraft Co.	Hornet	A.	Rad	9	4	D.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ryan Aeronautical Corp.*	Ryan-Siemens 5	A.	Rad	5	4	D.	70-1750	77-1850	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ryan Aeronautical Corp.*	Ryan-Siemens 7	A.	Rad	7	4	D.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ryan Aeronautical Corp.*	Ryan-Siemens 9	A.	Rad	9	4	D.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tips & Smith, Inc.†	Super-Rhone	A.	Rad	9	4	D.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Wright Aeronautical Corp.	Whirlwind J5	A.	Rad.	9	4	D.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Wright Aeronautical Corp.	Cyclone R1750	A.	Rad	9	4	D.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*—Engines of foreign manufacture
†—rebuilt
A—Air cooled
Aa—Aluminum alloy
Al—Aluminum
AS—Anzani or Scintilla
B—Battery ignition
Bs—Scintilla booster magneto
C—Cast iron
Cylinder Construction
first—head
second—walls or waterjacket
third—sleeve, if any
D—Direct
De—Delco
Dx—Dixie
E—Eclipse
G—Geared
G¹—4:3 spur ratio gear
G²—3:2 reduction gear
G.E.—General Electric
I—Inverted
L—Cylinders in line
Mo—Monel
M—Magneto
N—No
O—Own
ohc—Overhead cam
prr—Push rods and rocker arms
Rad—Radial
RB—Robert Bosch
Sc—Scintilla
Sg—Stromberg
Sg¹—Stromberg NA-U4 duplex
Sg²—Stromberg NAR-6G
Sp—Splitdorf
S—Steel
U—U.S.L. Electric
V—Vee
W—Water cooled
WS—Winfield
X—Extra
Y—Yes
Z—Zenith

A Modern and Efficient Engine for Light Planes



The Szekely SR-3, a three-cylinder 40 h.p. fixed radial type engine having a 4⅛ inch bore and 4½ inch stroke with a compression ratio of 4.5 to 1

THE design of the Szekely SR-3 was worked out with the idea in mind of producing the simplest and most efficient motor possible, using a minimum number of parts consistent with good practice and satisfactory performance.

The rated horsepower of the engine is forty at 1800 r.p.m. The dry weight of the engine is 144 pounds and the crated weight is 205 pounds. Tests have shown a gasoline consumption of .57 pounds per brake horsepower hour.

All of the valve mechanism is to the rear of the cylinders and crankcase, no visible parts but rocker arms are visible from the front. The oil pump and oil lines are self contained within the motor, the only outside lines being the tubes leading to and from the oil supply tank. The pump is mounted on the front of the crank case and is easily removed for inspection. The pump is of the geared type and is composed of two sections—the pressure pump and the scavenge pump. Oil in the crankcase drains to the lowest point where it enters the scavenge pump and returns to the tank. The oil connections are standard aircraft fittings, permitting the use of a conventional oil tube leading to the oil supply tank.

The crankshaft is a chrome nickel steel forging, heat treated and ground. The main bearings are cylindrical roller and the propeller thrust is taken by a deep groove ball bearing. The connecting rods are chrome nickel steel forgings, having a lower bearing construction putting all loads directly in line with a crankpin. The crankcase is an aluminum alloy casting, as are the front and rear crankcase covers. The pistons are aluminum alloy and the cylinders are nickel chromium alloy cast iron. The valves are alloy steel and fitted with two springs each.

The valve mechanism, though new to aircraft engines, is an old design with the corporation, having been developed several years ago for industrial engines and since produced and sold on more than 5,000 units. A single cam operates both valves through a system of individual rocker arms and push rods. The push rods rest on arms which pivot on a shaft above the cam and contact with the cam on either side. At the upper end, the push rods connect with a conventional rocker arm and pivot on a shaft lubricated through Alemite grease nipples.

The connecting rods are bushed at the upper end, and at the lower end all bearing diameters are concentric with the crankpin. The lower bearing of two rods are sections of a cylinder cut on an angle with the axis of the bearing and contact with a bronze back babbitt bearing which surrounds the crank pin itself. The third rod is the master rod, holding the assembly in place.

Two magnetos are furnished with the engine and are mounted side by side on a shelf cast integral with the rear crankshaft cover. The magnetos are gear driven and are operated through the ignition switch in the cockpit. The tachometer drive is taken off the gear reduction driving the oil pump shaft. The oil pressure relief screw is located in the rear crankcase cover at the end of the oil passage.

The mounting flange consists of a round machined pilot fitting into the engine bracket on the plane and six equally spaced studs.

All machine work on the engine is held to the highest standard and the assembly is carried out under the supervision of licensed mechanics. No effort has been spared to make the engine one to give uninterrupted service and to be as free from operating difficulties as possible.

Bulletin "A", which fully describes and illustrates the SR-3 and the Szekely five cylinder engine, is now available

O. E. SZEKELY CORPORATION
HOLLAND, MICHIGAN

SZEKELY ENGINES